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Ecological Factors Influencing the Occurrence of Macrofungi from Eastern Mountainous Areas to the Central Plains of Jilin Province, China

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Abstract: Macrofungi are essential in forest ecological functioning. Their distribution and diversity are primarily impacted by vegetation, topography, and environmental factors, such as precipitation and temperature. However, the composition and topographical changes of the macrofungi between the eastern mountainous area and central plains of Jilin Province are currently unknown. For this study, we selected six investigational sites representing three different topographical research sites in Jilin Province to assess macrofungal diversity, and applied a quadrat sampling method. Macro- and micro-morphological characteristics combined with the molecular method were used to identify the collected macrofungi. Meanwhile, selected meteorological data were obtained for statistical analysis. As a result, 691 species were identified, of which Agarics were the most common, accounting for 60.23%, while the Cantharelloid fungi were the least common (0.91%). Furthermore, most of the shared genera (species) were saprophytic. The α diversity showed that the species diversity and richness in Longwan National Forest Park (B2) were the highest at the genus level. The mycorrhizal macrofungi proportion revealed that Quanshuidong Forest Farm (A1) was the healthiest. Finally, species composition similarity decreased with the transition from mountainous to hilly plains. We concluded that the occurrence of macrofungi was most influenced by vegetation. The air humidity, precipitation, and wind velocity were also found to significantly impact the occurrence of macrofungi. Finally, the mycorrhizal:saprophytic ratios and species similarity decreased with the transition from the mountainous area to the plains. The results presented here help elucidate the macrofungi composition and their relationship with environmental factors and topography in Jilin Province, which is crucial for sustainable utilization and future conservation.

Keywords: ecology; environmental factors; forest type; forest health; landform; macrofungi occurrence

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1. Introduction

Human beings have discovered and utilized macrofungi throughout history with an awareness of the essential role in forest ecology. Macrofungi form mycorrhizal symbioses with host plants to promote the absorbance of substances, such as mineral elements and water. They also improve the tolerance of host plants to heavy metals, promote the survival and growth of afforestation and seedlings, and improve the diversity and stability of plants in the forest ecosystem. The comprehensive effects of macrofungi on the forest ecosystem are mainly manifested by increasing the plant–soil connections, improving the soil structure, promoting soil microorganisms, enhancing the function of plant organs, resisting antagonistic plant root disease pathogens, and degrading wood and other substances [1–4]. Saprotrophic macrofungi are also involved in the material cycle and energy flow, such as decomposing fallen timber and dead wood into other substances, such as lignin, cellulose, and hemicellulose [5,6], finally converted into glucose, fructose, etc.

Forests, as a habitat, are essential for the growth of macrofungi. Studies have shown that canopy openness, vegetation structure, and tree species richness strongly influence the occurrence of macrofungal functional groups [7]. Plant size, tree density, herb richness, and evenness could also affect the macrofungi composition [8]. Wood rotting fungi are strongly associated with tree species and the degree of wood decay [9]. Additionally, the species richness of macrofungi is also significantly related to forest management [10–12].

Topography is an abiotic factor that affects macrofungi community structures, as spatial eigenvectors—for example, slope—strongly connect with macrofungi occurrence [13]. Topography, more importantly, forms micro-habitats, thus creating differences in the key factors such as temperature, air humidity, and light, which affect the occurrence of macrofungi.

Furthermore, the occurrence and growth of macrofungi are closely related to environmental factors. For example, ectomycorrhizal macrofungi (EM fungi) are closely associated with their host plants, as Tuo et al. revealed the quantity of EM fungi in Wunvfeng National Forest Park, China, was positively correlated with the occurrence of *Quercus mongolica* [6]. Humidity is another critical factor, and Trudell et al. characterized the epigeous macrofungi communities in two old-growth conifer forests with a high level of similarity in their dominant tree species and proposed that the differences between the macrofungi communities were primarily related to the disparities in ecosystem moisture [14]. In addition, pH [15], soil temperature [16], and organic matter content [17,18] could also affect the occurrence of macrofungi.

There are apparent differences in the topography of Jilin Province. The terrain inclines from southeast to northwest and could be divided into two significant landforms: the eastern mountainous area and the central-western plains. The eastern mountainous area comprises the middle part of Mt. Changbai and its branches [19], accounting for 33% of the total area; hills account for 6% of the area. Due to the unique natural geographical environment and meteorological conditions, Jilin Province has become one of China's biodiversity hotspots. New macrofungi species have been discovered here, including *Cortinarius laccariphyllus* Y. Li and M.L. Xie; *Cortinarius neotorvus* Y. Li, M.L. Xie, and T.Z. Wei [20]; *Cordyceps changchunensis* J.J. Hu, Bo Zhang, and Y. Li; *Cordyceps changbaiensis* J.J. Hu, Bo Zhang, and Y. Li; and *Cordyceps jingyuetanensis* J.J. Hu, Bo Zhang, and Y. Li [21]. However, the macrofungi distribution patterns and the relationship with the environmental factors are currently unclear.

With this study, we aim to understand the species composition and macrofungal distribution in the central and eastern areas of Jilin Province and analyze the relationship between their occurrence and environmental factors. In addition, we analyze the changes in the macrofungi composition about to topography.

2. Materials and Methods

2.1. Introduction of Investigation Site

Jilin Province has a temperate continental monsoon climate, with four distinct seasons, rain and heat in the same season, noticeable seasonal changes, and regional differences in temperature and precipitation. The average temperature is below −11 °C in the winter and above 23 °C in the summer [22–24], and the average annual precipitation is 400–600 mm [25–27]. However, precipitation significantly differs between seasons and regions, as 80% is concentrated in the summer, and the eastern area is the richest.

Six representative investigation sites were selected to assess the macrofungi resources and analyze the relationships between macrofungi occurrence in eastern Jilin Province, China, in detail (Figures 1 and 2 and Table 1). These sites are Mt. Changbai area (A)—Quanshuidong Forest Farm (A1) and Lushuihe National Forest Park (A2); Mt. Changbai branches, Mt. Laoyeling branch (B)—Shengli River Forest Farm (B1) and Mt. Longgang branch—Longwan National Forest Park (B2); and low hilly plain areas (C)—Zuojia Region (C1) and Jingyuetan National Forest Park (C2). The investigation also aimed to improve our understanding of the composition transitions from the eastern to central regions, which cause changes in topography, vegetation, precipitation, and temperature.

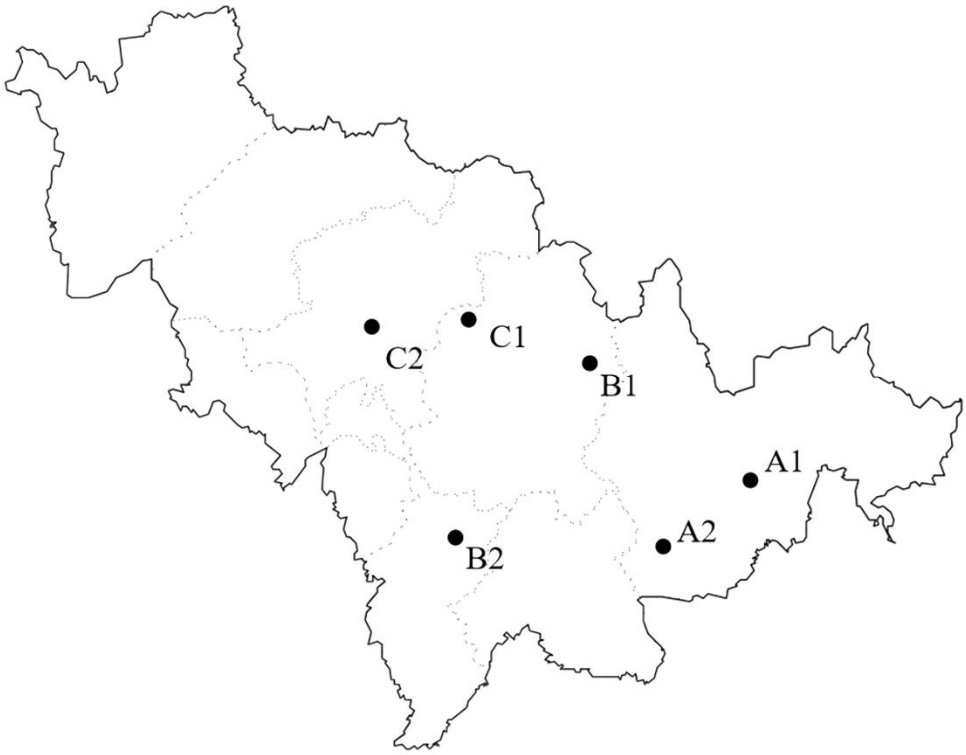

Figure 1. Distribution map showing the investigation sites in Jilin Province (A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Park; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park).

Table 1. Geographical coordinates and vegetation of the investigation sites.

Investigation Sites	Longitude	Latitude	Vegetation	Soil Type	Investigation Time
Quanshuidong Forest Farm (A1)	128.89° E	42.68° N	*Pinus* and broadleaf mixed forest, *Quercus* and *Poplar* forest, *coniferous* forests (*Pinus koraiensis*), *Taxus cuspidata*, *Salix* spp., etc.	Dark brunisolic soil and planosol soil	2014–2016
Lushuihe National Forest Park (A2)	128.01° E	42.55° N			2013–2015
Mt. Laoyeling (Shengli River Forest Farm, B1)	127.83° E	43.69° N	*Pinus koraiensis* and broadleaf mixed forest, larch forest, *Quercus mongolica* forest, *Acer truncatum*, *Tilia amurensis*, and *Fraxinus mandshurica*, etc.	Dark brunisolic soil and planosol soil	2005–2007
Mt. Longgang (Longwan National Forest Park, B2)	126.45° E	42.37° N	*Quercus mongolica* forest and broadleaf mixed forest	Dark brunisolic soil	2011–2013
Zuojia Region (C1)	126.16° E	44.03° N	*Quercus mongolica* forest, spruce forest, and pine forest	Black soil and paddy soil	2011–2013
Jingyuetan national forest park (C2)	125.48° E	43.79° N	Larch forest, *Pinus* forest, and *Quercus mongolica* forest	Dark brunisolic soil	2003–2006

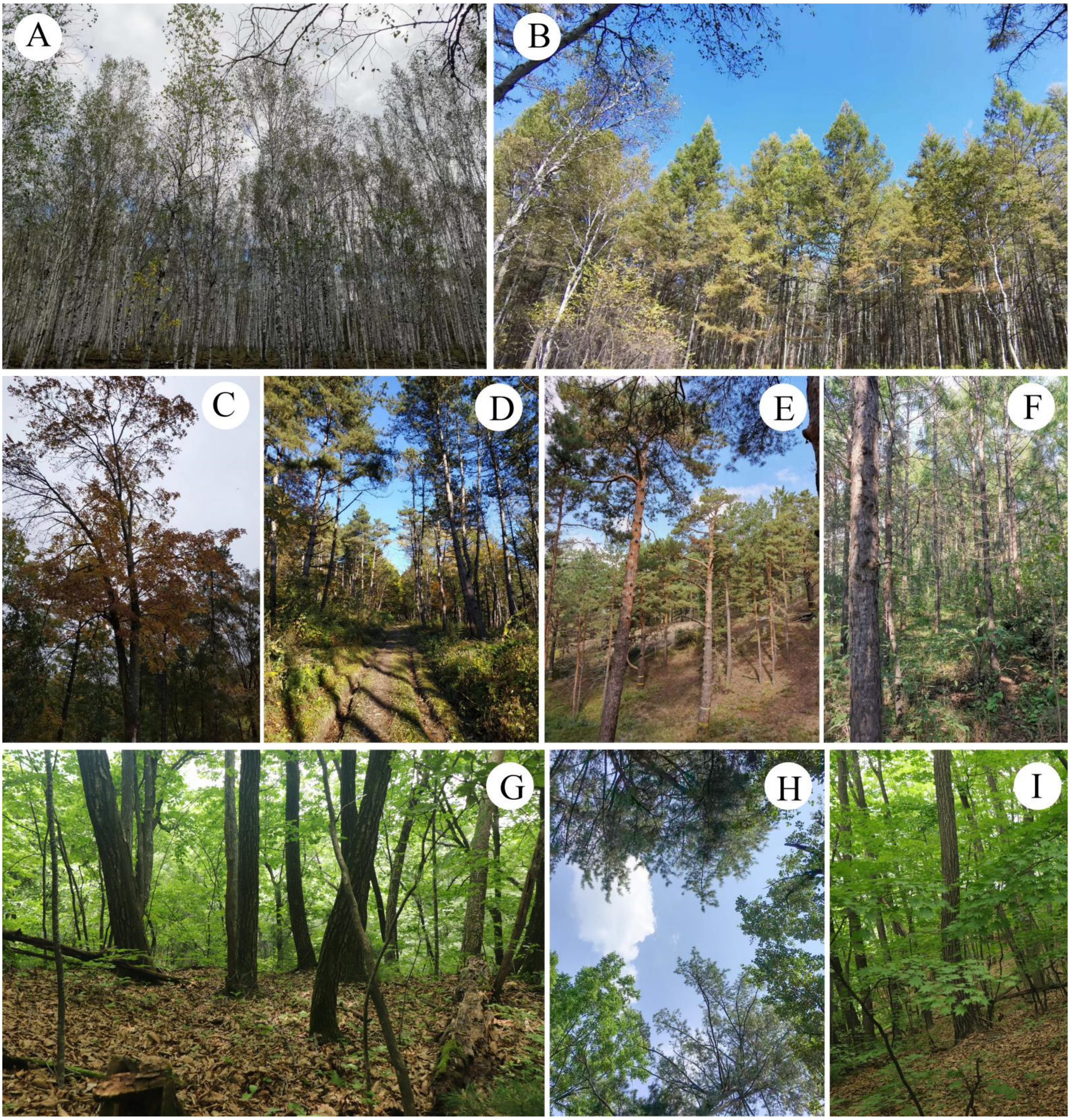

Figure 2. Forest types from the investigation sites in Jilin Province. (**A**) *Betula platyphylla* forest; (**B**) *Cunninghamia* forest; (**C**) broadleaf mixed forest (mainly *Acer* sp.); (**D–F**) *Pine* forest; (**G**) *Quercus mongolica* forest; (**H**) Coniferous and broadleaf mixed forest (*Pinus* and broadleaf mixed forest); (**I**) *Quercus mongolica* forest.

(1) Quanshuidong Forest Farm (A1)

Quanshuidong Forest Farm, located in Helong City, Jilin Province, belongs to the mid-temperate monsoonal semi-humid climate zone. The annual average temperature is 5.6 °C, and the effective accumulated temperature at 10 °C is 2534.0 °C. The average yearly precipitation is 573.6 mm, and the frost-free period is approximately 138 days [28].

(2) Lushuihe National Forest Park (A2)

Lushuihe National Forest Park, located in Fusong County, Baishang City, Jilin Province, belongs to the temperate monsoon climate. The annual average temperature is 2.9 °C, and the effective accumulated temperature at 10 °C is 2606.9 °C. The average yearly precipitation is 894 mm, and the frost-free period is approximately 110 days [29].

(3) Laoyeling Branch—Shengli River Forest Farm (B1)

Mt. Laoyeling belongs to the Mt. Changbai Systems and is in the northeast–southwest direction, 800–1000 m above sea level in Jilin Province, with a relative height of approximately 500 m. The landforms are mainly low and middle mountains, with narrow valleys between the mountains. Volcanoes and lava flows are widely distributed in this area [27].

Shengli River Forest Farm has a temperate continental climate with an average annual temperature of 3.8 °C, an average annual rainfall of 633.7 mm, and a frost-free period of 110–130 days.

(4) Longgang Mountain Branch—Longwan National Forest Park (B2)

Longwan National Forest Park is in the middle section of Mt. Longgang in Huinan County, Jilin Province, with an average sea level of 880 m. It has a northern temperate continental monsoon climate. The annual average temperature is 4.8 °C, the minimum temperature is −17 °C, and the maximum monthly average temperature is 22.4 °C. The sufficient accumulated temperature at 10 °C is 2728 °C. The average annual precipitation is 837.9 mm, ranging from 436.5 to 987.2 mm. The maximum daily precipitation is 124.2 mm, concentrated from June to August, with an average yearly frost-free period of 138 days and an average sunshine time of 2296 h [30].

(5) Zuojia Region (C1)

The Zuojia area, Jilin Province, belongs to the hilly plain areas of Mt. Changbai. It has a continental climate with temperate monsoons and often experiences Siberian cold waves, with changeable weather and distinct seasons. The annual average temperature is 5.6 °C, and the effective accumulated temperature at 10 °C is 2779.8 °C. The average yearly precipitation is 679 mm, the average annual evaporation is 1200 mm, and the frost-free period is approximately 120 days [31–33].

(6) Jingyuetan National Forest Park (C2)

Jingyuetan National Forest Park is in the transitional zone from the eastern mountain area to the western grasslands of Jilin Province. It belongs to the hill areas of Mt. Changbai. The elevation is between 245.8 and 371.6 m above sea level. The climate is temperate semi-dry, early, and semi-humid monsoon with four distinct seasons. The annual average temperature is 6.1 °C. The average annual precipitation is 577.3 mm. The rainy season is mainly concentrated in July and August, as it accounts for 67% of the annual precipitation, the annual evaporation is 1392.5 mm, and there is a frost-free period of 145 d [34].

2.2. Macrofungi Investigation

(1) Investigation

In this study, four plots were selected at each investigation site in which three quadrats of 10 m × 10 m [35] were set in parallel at each plot, and each plot was numbered with a distance of 300 m, applied with a quadrat sampling method.

(2) Specimen collection and recording

Specimens were mainly collected from July to September at every investigation site. The specimens were photographed in situ. The habitat, altitude, soil characteristics, and nearby trees were recorded. The size of basidiomata was measured when fresh, and features such as striations, hygrophanous, and squama were noted (Figure 3). After examining and describing the fresh macroscopic characters, the specimens were dried in an electric drier at 45–50 °C. All the collected specimens had conspicuous basidiomata.

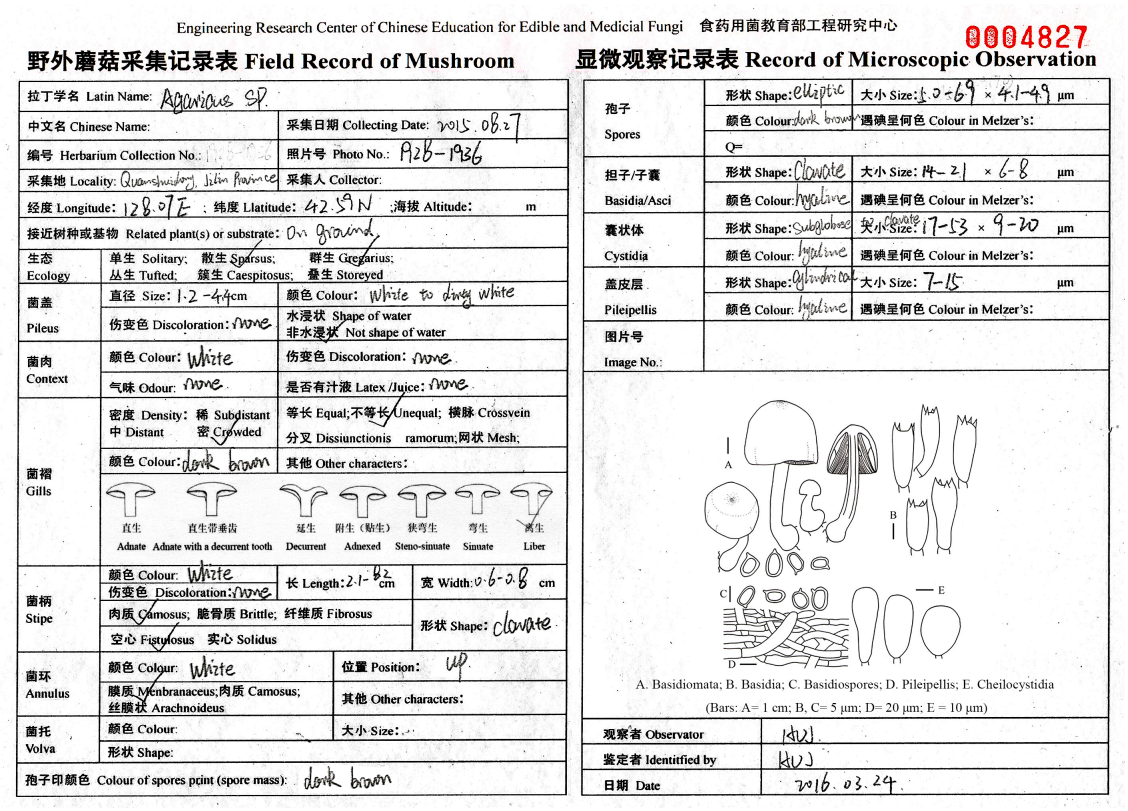

Figure 3. An example of field record and microscopic observation record of the collected specimen.

(3) Specimen identification

The dried specimens were rehydrated in 94% ethanol for microscopic examination, then mounted in 3% potassium hydroxide (KOH), 1% Congo red, and Melzer's reagent; they were then examined with a Zeiss Axiolab A1 microscope (Carl Zeiss, Jena, Germany) at magnifications up to 1000×. All measurements were taken from the sections mounted in 1% Congo red. A minimum of 40 spores, 20 basidia/asci, 20 cystidia, etc., were measured from at least two different fruiting bodies for each specimen [36]. When combined with the macroscopic characteristics, the classification status of the specimens was determined by referring to literature and monographs [37]. For some species, we also sequenced, and the sequences have been deposited in GenBank (GenBank accession numbers: ON683416–ON683495). The taxonomic status of all species is referenced in the Index Fungorum [38]. The specimens examined were deposited in the Herbarium of Mycology of Jilin Agricultural University (HMJAU).

(4) Data collection

The meteorological data—average temperature (T), average relative humidity (RH), average monthly precipitation (P), average wind speed, and accumulated temperature from July to September (AT)—were downloaded from the China meteorological data network [39]. The soil type and representative forest type data were obtained from the Chinese Academy of Sciences (Table 2) [40].

2.3. Data Analysis

Two alpha diversity indices, the Simpson diversity index [41] and the Shannon–Wiener index [42], were calculated at the genus level for each investigation site to analyze the community composition of the macrofungi. The Shannon index (H′) reflected the diversity of the community species. The Simpson index (D) reflected the probability of two individuals being randomly selected from the same sample, and these two individuals are from the same class.

Table 2. Meteorological conditions and types of soil at the investigation sites.

Investigation Site	The Average Temperature from July to September/°C (T)	The Average Relative Humidity from July to September/% (RH)	The Average Monthly Precipitation from July to September/mm (P)	The Average Wind Speed from July to September/m/s (S)	The Accumulated Temperature from July to September/°C (AT)
Quanshuidong Forest Farm (A1)	18.60	80.67	152.27	1.57	1715.90
Lushuihe Town (A2)	19.60	81.67	143.27	1.67	1698.9
Mt. Laoyeling—Shengli River Forest Farm (B1)	17.67	79.00	118.63	1.90	1629.80
Mt. Longgang—Longwan National Forest Park (B2)	19.53	78.33	170.77	1.23	1746.40
Zuojia Region (C1)	19.93	77.00	124.43	2.03	1838.60
Jingyuetan National Forest Park (C2)	20.43	74.00	116.03	2.83	1884.30

The compositions of the macrofungi at Mt. Changbai (A), the transitional zone (B), and the plain hilly area (C) were compared by calculating the similarity coefficient (S) [43] and generating a complex heatmap [44]. The macrofungi compositions between Mt. Changbai and Mt. Laoyeling branch and Mt. Longgang Branch were also compared.

The diversity index formulae were as follows:

$$H' = -\sum Pi \ln(Pi) \tag{1}$$

$$D = 1 - \sum Pi^2 \tag{2}$$

$$S = \frac{2a}{b+c} \times 100 \tag{3}$$

where Pi is the proportion of species i to the total number of individuals of all species in the plot, a is the number of genera shared by the two places, and b and c are the genera that appear in the same place.

According to the *Atlas of Chinese Macrofungal Resources* [37], identified species were divided into eight categories: Larger Ascomycete, Agarics, Polyporoid, Hyonaceous and Thelephoroid fungi (PHT fungi), Cantharelloid fungi, Gasteroid fungi, Jelly fungi, Coral fungi, and Boletes.

The identified genera were summarized in an Excel table. Then, we specified a value of 0/1 for each genus shown at each investigation site (0 means that the genus did not appear at the investigation site). Originpro 2019 (OriginLab, Northampton, USA) was used to analyze common genera. Dominant family (number of species more than ten of the family) and dominant genus (number of species more than five of the genera) of each investigation site were counted [45]. Moreover, the species numbers per family (genera) at all six investigation sites were statistics, the top ten families (genera) were shown, and the bubble matrix was drowned.

The software Canoco 5.0 (Micro-computer Power, Ithaca, NY, USA) [46] fits and analyzes the relationship between macrofungi species and the environmental factors at six investigation sites. Log (n + 1) was used to reduce meteorological data quality and balance the vast differences among the various factors. The quadrat × species matrix and the quadrat × environment matrix were established. Two-dimensional sorting and canonical correspondence analysis (CCA) of macrofungi and environmental factors in six different vegetation types were conducted.

3. Results

3.1. Composition Characteristics of the Macrofungi

In this study, genera with more than four species were chosen from the six investigation sites for analysis. Site A1 included the most identified families and species among six investigation sites, while site B2 had the fewest (Figure 4). General overview, *Russula* Pers., *Pholiota* (Fr.) P. Kumm., and *Mycena* (Pers.) Roussel, etc., were the most common genera recorded. Taxa belonging to *Russula* and *Mycena* were the most common at site A1; *Pholiota* and *Polyporus* were the most common ones at site A2; *Russula*, *Pholiota*, and *Hygrophorus* Fr. were the most reported genera at site B1; *Russula* and *Amanita* Pers were the most recorded at site B2; *Russula*, *Suillus* Gray, and *Pholiota* were the most reported at site C1; *Russula*, *Suillus*, and *Agaricus* L., were the most common genera at site C2. Overall, the most reported one is *Russula*.

Figure 4. Circos plot shows the relative abundance of macrofungi in six different sites in Jinlin Province based on the genera with more than four species. The analysis of species abundance shows *Russula* was the common genus and site A1 contains more species than the other five investigation sites. A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Form; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park.

3.2. Shared Genera (Species) Analysis

A total of 691 species of macrofungi, belonging to 258 genera and 81 families, were identified (Table A1). There were 23 genera—including *Ampulloclitocybe* Redhead, Lutzoni, Moncalvo and Vilgalys, *Cortinarius*, and *Pleurotus*—identified at all six investigation sites (Figure 5A).

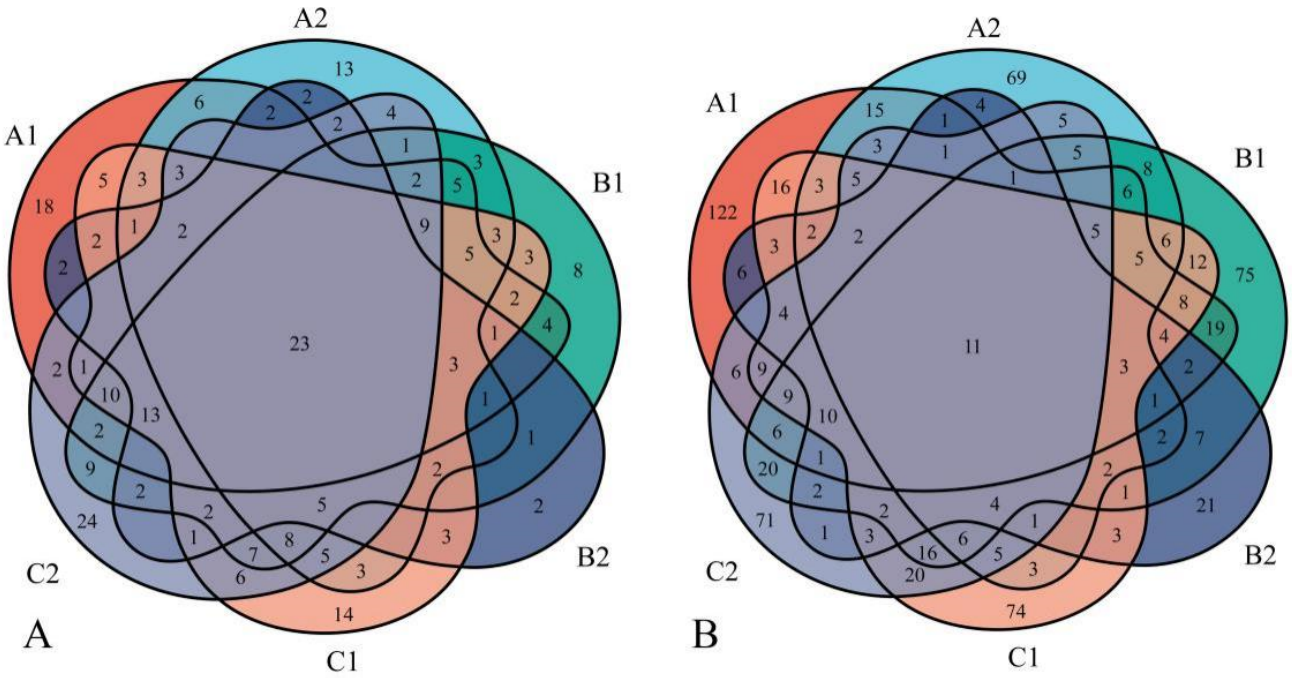

Figure 5. The co-occurring genera and species were analyzed in six different investigation sites in Jilin Province. (**A**) Co-occurring genera analysis in six investigation sites; 23 genera co-occur in six investigation sites; site B2 has the fewest endemic genera and C2 has the most. (**B**) Co-occurring species analysis in six investigation sites; 11 species occur in all six investigation sites; site A1 has the most endemic species, while site B2 has the fewest. A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Park; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park.

Furthermore, 11 species, such as *Ampulloclitocybe clavipes* (Pers.) Redhead, Lutzoni, Moncalvo and Vilgalys, *Daldinia concentrica* (Bolton) Ces. and De Not., and *Ganoderma applanatum* (Pers.) Pat., co-occurred at each survey site (Figure 5B). Site A1 has the most endemic species, while site B2 has the fewest.

3.3. Macrofungi Composition Types Analysis

According to the *Atlas of Chinese Macrofungal Resources* [37], the macrofungi species were divided into eight statistical categories. Agarics were the most common, accounting for 60.23% of the total, followed by PHT fungi, accounting for 16.50%. In contrast, Jelly fungi and Cantharelloid fungi were rarely reported, accounting for 2.06% and 0.91%, respectively (Figure 6A).

The statistical analysis of each investigation site (Figure 6B) showed that Agarics and PHT fungi were predominant at sites A1, A2, B1, B2, C1, and C2, while Agarics and Jelly fungi were the most common at site B2. Coral fungi and Cantharelloid fungi were rarely reported at sites A1, A2, and B2. Jelly fungi and Cantharelloid fungi were seldom reported at sites B1, C1, and C2. In summary, Cantharelloid fungi were rare in all investigations, while the compositions of macrofungi at six investigation sites were vastly different.

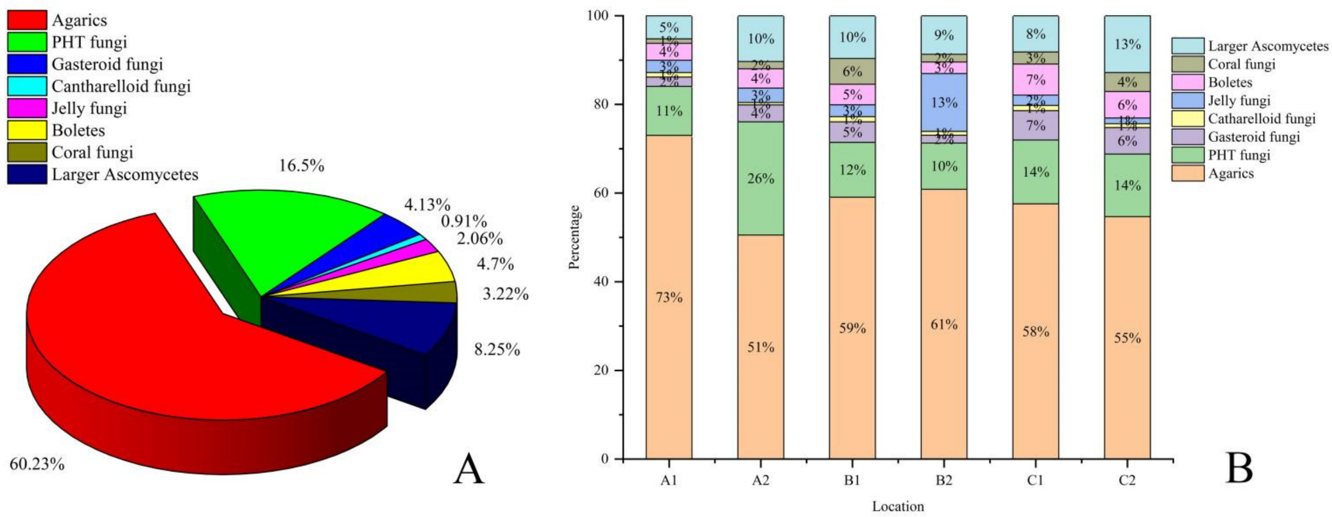

Figure 6. Distribution proportions for different types of macrofungi in six different investigation sites from Jilin Province. (**A**) Analysis of all recorded species composition types of our investigation sites; Agarics were the most common macrofungi while Canthralloid fungi were rare. (**B**) Species composition type analysis of every investigation site; Agarics were predominant at every site, Cantharelloid fungi were rare at all sites, and the compositions of macrofungi at six investigation sites were enormously different. PHT fungi: Polyporoid, Hyonaceous and Thelephoroid fungi; A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Park; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park.

3.4. Ecological Characteristics of Macrofungi

According to the reference [6] and FUNGuild [47], the numbers of mycorrhizal macrofungi and saprophytic macrofungi were counted. The proportion of mycorrhizal macrofungi at site A1 was the highest (0.47), indicating that the forest structure at this site was the healthiest and the most stable. While the proportion was the lowest at site C1 (Table 3).

Table 3. Mycorrhizal:saprophytic macrofungi ratios of the investigation sites from Jilin Province.

Sites	A1	A2	B1	B2	C1	C2
Mycorrhizal	92	76	77	30	60	57
Saprophytic	197	170	181	75	196	175
Ratio/%	0.47	0.45	0.43	0.40	0.31	0.33

3.5. Analysis of α Diversity

The α diversity at six investigation sites was analyzed (Figure 7). The summary statistics from the Simpson diversity index for site B2 were significantly higher than those from the other five investigation sites. This result indicated that site B2 had the richest species diversity at the genus level and the most uniform distribution of species quantity (Figure 7A). The Shannon–Wiener index results also indicated that the diversity at site B2 was the highest, and the species were the richest (Figure 6B).

3.6. Analysis of Dominant Families (Genera)

According to the identification results, 81 families were recorded. The top ten families were *Russulaceae*, *Tricholomataceae*, *Agaricaceae*, etc., successively, containing 43.54% of the total species (Table 4). There were 24 families with only one species, accounting for 29.63%. The dominant families at each investigation site are shown in Figure 8A.

A total of 258 genera were reported in this study, among which the top ten genera were *Mycena* (Pers.) Roussel, *Cortinarius* (Pers.) Gray, *Lactarius* Pers., etc., accounting for 22.46% (Table 4). There were 137 genera with only one species, accounting for 53.10%. The dominant genera are shown in Figure 8B.

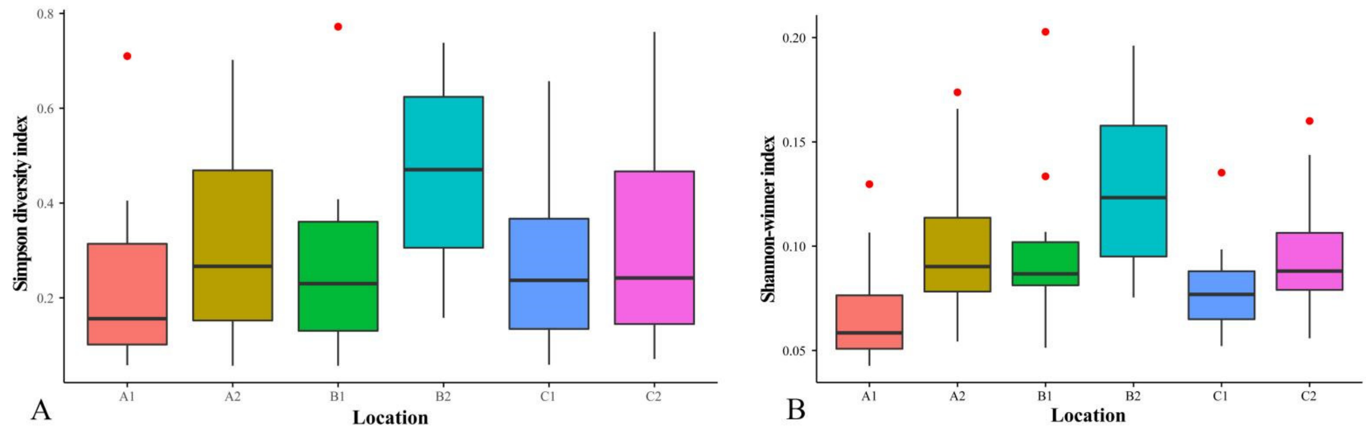

Figure 7. Diversity index analysis at genus level in six different investigation sites from Jilin Province. (**A**) Simpson diversity analysis in six different investigation sites from Jilin Province; the Simpson diversity index revealed site B2 was higher than the other five sites. (**B**) Shannon–Wiener diversity analysis in six different investigation sites from Jilin Province; the Shannon–Wiener diversity analysis showed site B2 was higher than the other five investigation sites. This result indicated that site B2 had the richest species diversity at the genus level and the most uniform distribution of species quantity. A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Park; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park.

Table 4. Top 10 families and genera in six different investigation sites from Jilin Province.

No.	Family	Numbers of Species	Percentage	Genus	Numbers of Species	Percentage
1	*Agaricaceae*	52	7.07%	*Lactarius*	20	2.72%
2	*Polyporaceae*	50	6.80%	*Mycena*	19	2.59%
3	*Tricholomataceae*	41	5.58%	*Cortinarius*	18	2.45%
4	*Inocybaceae*	34	4.63%	*Marasmius*	18	2.45%
5	*Strophariaceae*	33	4.49%	*Pholiota*	18	2.45%
6	*Hygrophoraceae*	25	3.40%	*Agaricus*	16	2.18%
7	*Marasmiaceae*	25	3.40%	*Entoloma*	16	2.18%
8	*Mycenaceae*	23	3.13%	*Amanita*	14	1.90%
9	*Cortinariaceae*	19	2.59%	*Crepidotus*	13	1.77%
10	*Omphalotaceae*	18	2.45%	*Inocybe*	13	1.77%

3.7. Relationships between Macrofungi and Environmental Factors

At first, the number of macrofungi collected from May to October at the three investigation sites was analyzed statistically. The results showed that they mainly arose from July to September, with minimal presence in May, June, and October (Figure 9).

Secondly, the relationship between macrofungi and environmental facts—air humidity, precipitation, and temperature were also analyzed. Macrofungi occurrence was positively correlated with air humidity (Figure 10). When air humidity was higher, larger numbers of macrofungi were shown from July to September. Precipitation from May to October was positively correlated with macrofungi occurrence with a lag period (Figure 11).

Then, the relationship between the average temperature from May to October and macrofungi occurrence was also analyzed. The results showed that macrofungi occurrence at sites A1 (Figure 12A) and B2 (Figure 12B) was positively correlated with air temperature, and there was a relative lag period. However, numerous macrofungi occurred in September at site C2 (Figure 12C), while the monthly average temperature was significantly lower than from June to July. Further analysis of the meteorological data shows that the daily temperature difference at site C2 was significant in September, stimulating macrofungi formation.

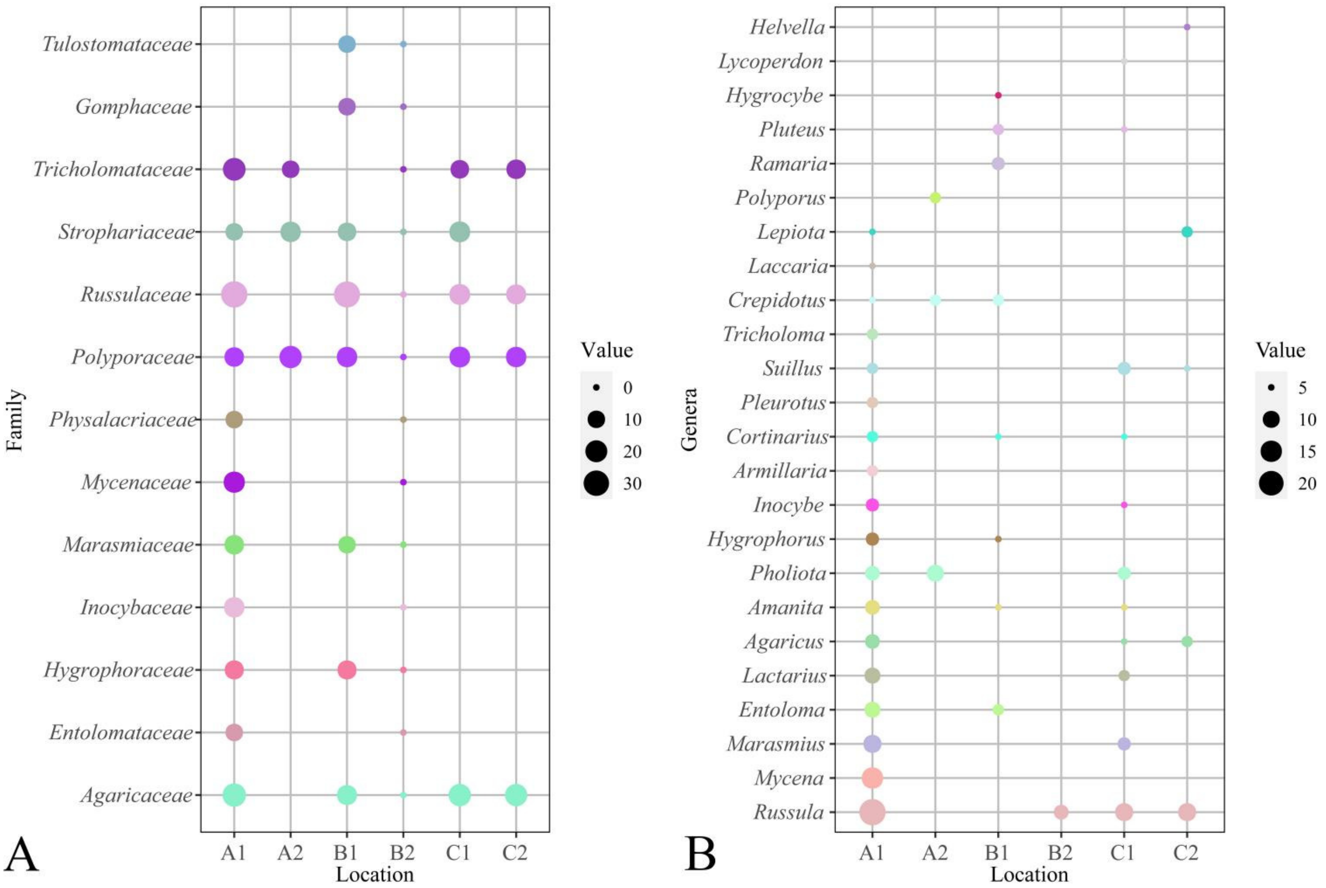

Figure 8. Dominant families and genera of six investigation sites from Jilin Province. (**A**) Dominant families (number of species more than ten of the family) analysis of six investigation sites from Jilin Province. (**B**) Dominant genera (number of species more than five of the genera) analysis of six investigation sites from Jilin Province. The results show site A1 contains more dominant families and genera in six investigation sites; in contrast, site B2 includes few. A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Park; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park.

At last, a canonical correspondence analysis (CCA) was performed on the genera with the top 50% species numbers recorded at the six investigation sites. Five environmental factors—adequate accumulated temperature (AT), monthly mean air temperature from (T), mean humidity (RH), mean precipitation (P), and mean wind speed from July to September (S)—were selected for CCA. The results (Figure 13) showed that all samples were roughly separated into six groups according to their corresponding locations. Eigenvalue axis 1 is higher than axis 2, with cumulative contributions of 32.70% and 28.50%, respectively. The selected environmental factors were found to impact the macrofungi occurrence. Of all the established ecological factors, the mean humidity from July to September, mean precipitation from July to September, and mean wind speed from July to September were the most significant factors.

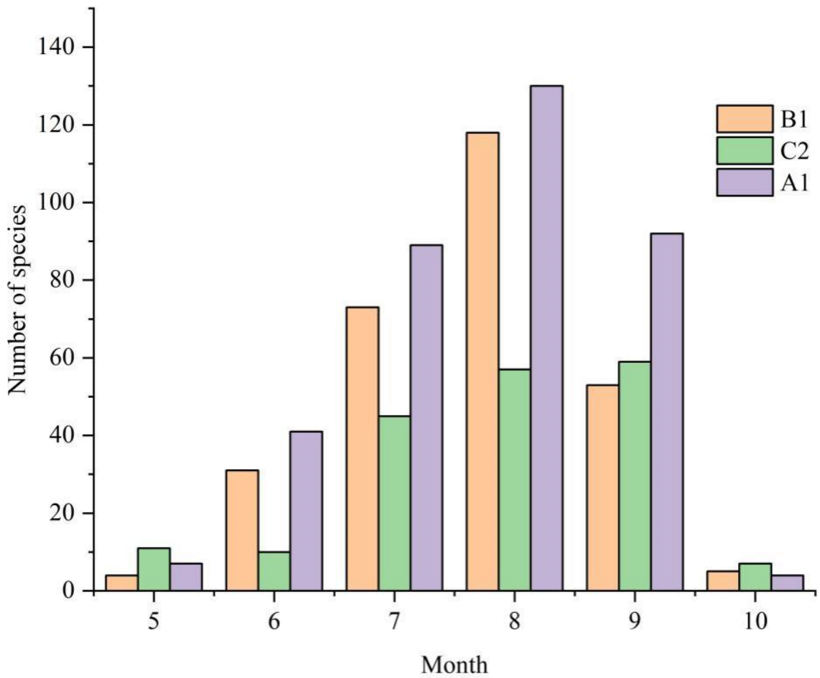

Figure 9. Relationship between macrofungi occurrence and month in three different investigation sites from Jilin Province. The results showed that they mostly arose from July to September. A1: Quanshuidong Forest Farm; B1: Shengli River Forest Farm; C2: Jingyuetan National Forest Park.

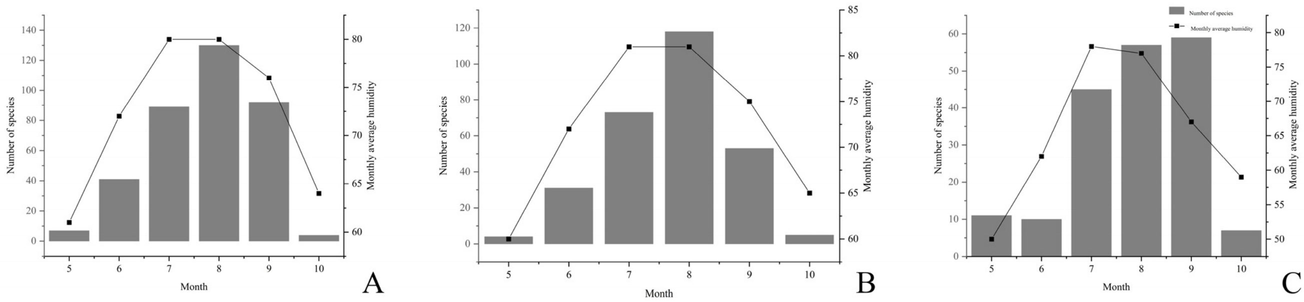

Figure 10. Effect of air humidity on the occurrence of macrofungi in three different investigation sites from Jilin Province. (**A**) Quanshuidong Forest Farm; (**B**) Shengli River Forest Farm; (**C**) Jingyuetan National Forest Park.

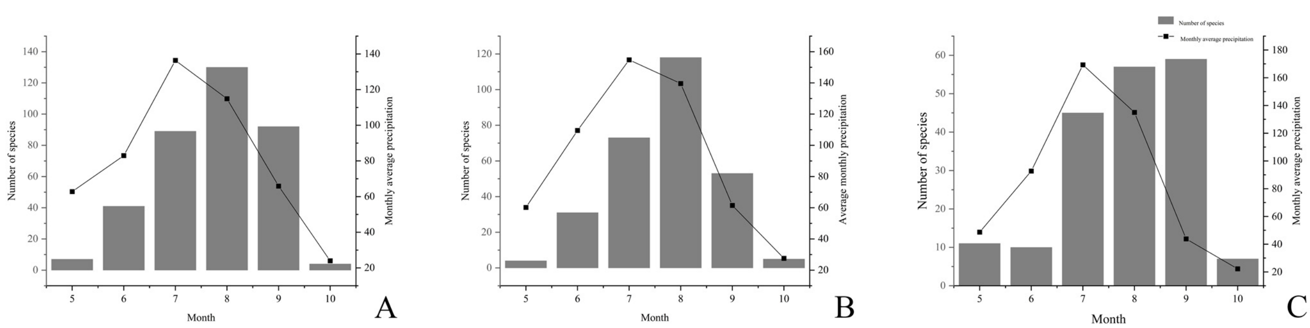

Figure 11. Effect of precipitation on the occurrence of macrofungi in three different investigation sites from Jilin Province. (**A**) Quanshuidong Forest Farm; (**B**) Shengli River Forest Farm; (**C**) Jingyuetan National Forest Park.

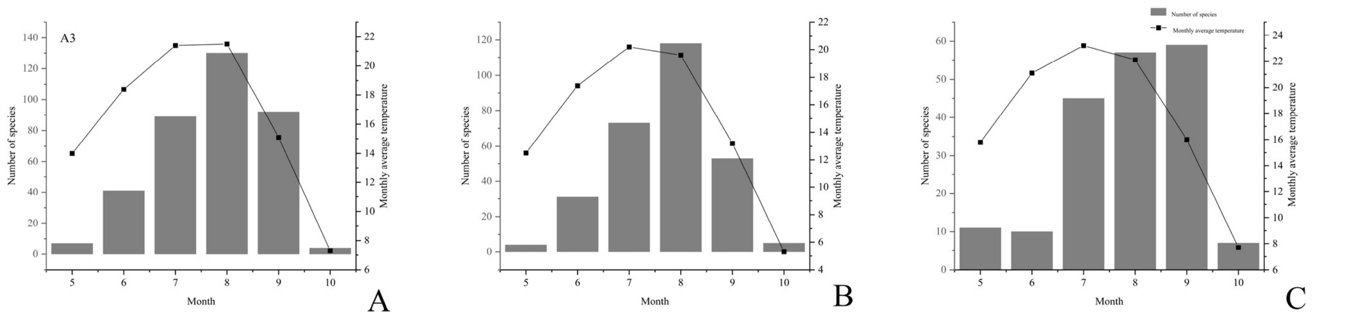

Figure 12. Effect of temperature on the occurrence of macrofungi in three different investigation sites from Jilin Province. (**A**) Quanshuidong Forest Farm; (**B**) Shengli River Forest Farm; (**C**) Jingyuetan National Forest Park.

3.8. Analysis of Flora Diversity

The six investigation sites were divided into three groups: Mt. Changbai area (A), containing Quanshuidong Forest Farm (A1) and Lushuihe National Forest Park (A2); Mt. Changbai Branch (B), comprising the Mt. Longgang Branch (Longwan National Forest Park, B1) and the Mt. Laoyeling Branch (Shengli Forest Farm, B2); and plain low hilly areas (C), encompassing the Zuojia Region (C1) and Jingyuetan National Forest Park (C2). The macrofungi composition was found to change when the mountainous region transited to the plains and low hills, and this was determined by calculating the similarity coefficient (s). The similarity decreased from 42.06% to 39.95% (Table 5).

Table 5. Similarity comparison between Mt. Changbai, its branches, and five other investigation sites.

Location	B	C	B1	B2	C1	C2
S/%	42.06	39.95	37.23	32.39	26.85	30.88

Simultaneously, the macrofungi compositions of Mt. Changbai, its Laoyeling Branch (B1), and the Mt. Longgang Branch (B2) were compared. The similarity between Mt. Changbai and Laoyeling Branch (B1) was 37.23%, higher than the Mt. Longgang Branch.

The top 30 genera were selected to analyze the speciation differences (Figure 14). The composition of site C1 was the most similar to site C2, followed by site B2 and site B1, and site A was the least similar, which was consistent with the results for the similarity coefficient. The similarity of the species composition in Mt. Changbai Branch was lower than that in the plain low hilly area.

Substantial differences were seen in forming distinct genera among the six sites. The number of species in each genus was generally higher for area A and lower for site B2.

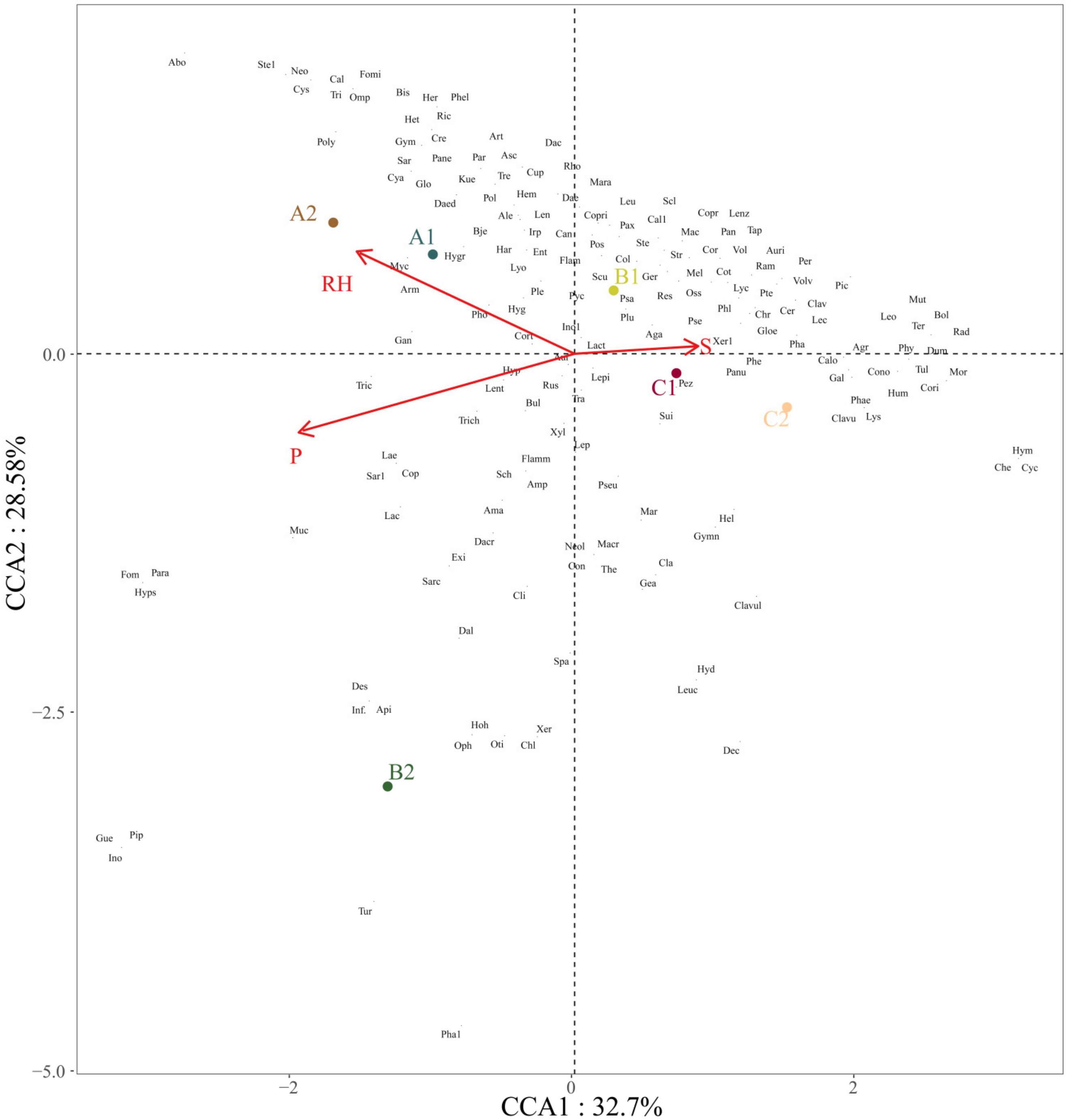

Figure 13. Canonical correspondence analysis (CCA) of the selected environmental factors and the recorded macrofungi species. All displayed environmental factors passed the most significant test ($p < 0.05$); P: mean precipitation from July to September; S: mean wind speed from July to September; RH: mean humidity from July to September; A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Park; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park. Letters are composed of the first three- or four-letter abbreviations of the scientific name, and the corresponding words are provided in Table A2.

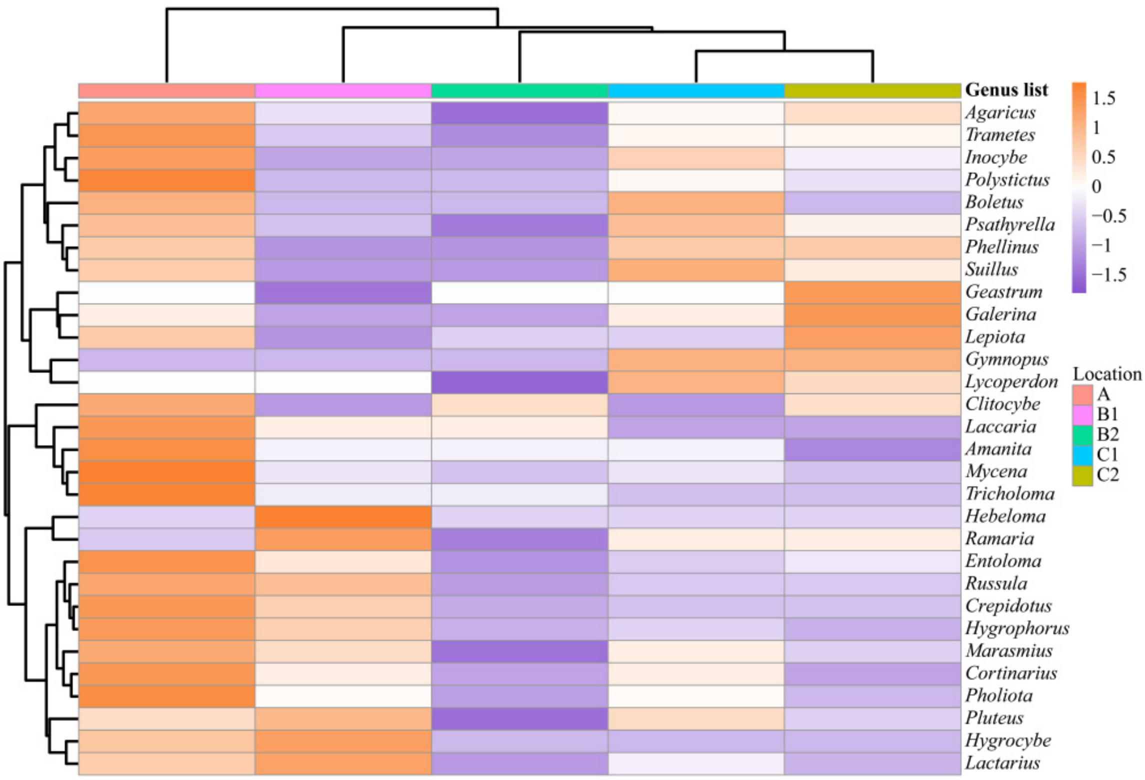

Figure 14. Complex heatmap of the macrofungi composition (genus level) at six investigation sites from Jilin Province. A1: Quanshuidong Forest Farm; A2: Lushuihe National Forest Park; B1: Shengli River Forest Farm; B2: Longwan National Forest Park; C1: Zuojia Region; C2: Jingyuetan National Forest Park.

4. Discussion

4.1. The Influence of Environmental Factors on Macrofungi Occurrence

CCA at the genus level of recorded macrofungi at six investigation sites showed that the mean humidity, mean precipitation, and mean wind speed from July to September were the most significant environmental factors influencing the occurrence and distribution of macrofungi.

The effect of wind speed on macrofungi is integrated and multifaceted. The most direct impact is an expansion of the dispersal of the spores range, promoting species dispersal and affecting the macrofungi's community structure by promoting the formation of dominant populations and reducing the macrofungi species richness within the same plant community [48]. Wind speed will also affect the oxygen content of the plant–macrofungi community. The high oxygen content will influence the oxygen content of soil [49], thus promoting hyphae respiration—the more energy released, the more promotion of mycelium growth [50]. Oxygen content will also affect the fruiting body morphogenesis, and elevated carbon dioxide will result in the formation of deformed mushrooms, thus affecting the macrofungi growth (e.g., the height of fruiting bodies lower than average) [51,52]. Wind speed will also affect soil moisture and air humidity [53]. From a positive perspective, water evaporation and transpiration will increase air humidity and adjust soil and air temperature, which benefits fruiting body formation. However, if the soil moisture evaporates excessively during spore germination and vegetative hyphal growth, excessive evaporation of the soil moisture will inhibit spore germination and promote hyphal reproductive growth or dormancy [54–56]. Furthermore, soil dryness caused by high winds may be a reason that macrofungi become gasteroid.

Precipitation will increase the soil water content, enabling resting spores to obtain sufficient water levels. For spores with thick walls, water immersion is essential. Sufficient soaking softens the walls, triggering enzymes hydrolysis of the spore's peptidoglycan cortex, enabling the mycelium to germinate more efficiently [57]. Water immersion will also dissolve the substances that inhibit spore germination into the water and release dormancy [58]. Furthermore, water can promote spore respiration and sugar decomposition, provide energy for growth activities, and stimulate spores to secrete various enzymes to destroy cell wall structures [59]. With the gradual temperature increase, the spores were found to absorb enough water to germinate gradually. The suitable temperature and humidity conditions were sufficient for the mycelium to grow in large quantities, laying the foundations for macrofungi occurrence [60,61]. However, this phenomenon depends on vital mechanisms of the spore, for dead spores do not swell, and absorption varies with the viability of the spore [62]. The swelling of spores is usually more than twice its original size [63], and with further germination, the protoplasm volume can sometimes increase more than ten times.

Relative humidity mainly affects the dispersal of spores. If the air humidity is too high, the weight/volume will also increase, thus reducing the dispersal range of spores [64]. The evidence shows that the RH had no direct influence on the growth of macrofungi [53]. If water is available on the surface, macrofungi may grow at deficient air humidity levels [65,66]. RH may also influence the growth of mycelia. Excessively high RH would slow down or inhibit mycelium growth [67].

Mushrooms also arise from primordia that their formation and differentiation are influenced by environmental factors such as precipitation and temperature. From 1993 to 2007, Krebs et al. [68] found that mushroom production could be predicted by summer rainfall, in Yukon, the mushroom production is positively correlated with precipitation. Low humidity will slow down the growth rate during primordia formation [69]. The temperature is also another critical factor. The formation of some mushroom's primordia requires low-temperature stimulation, such as *Flammlina filiformis* (Z.W. Ge, X.B. Liu, and Zhu L. Yang) P.M. Wang, Y.C. Dai, E. Horak, and Zhu L. Yang. The diverse climate types and environments allow different macrofungi to specialize and thrive [70].

4.2. The Influence of Vegetation on Macrofungi Occurrence

The Mt. Longgang and Mt. Laoyeling branches both belong to Mt. Changbai. However, the species richness in the Longwan National Forest Park (B2) was found to be higher than that at Mt. Changbai (A) and its Mt. Laoyeling branch (B1). This phenomenon may be due to the differences in their vegetation [71]. Mt. Changbai and its Mt. Laoyeling Branch are mainly covered by coniferous trees, including *Pinus* spp., *Picea* spp., etc. In contrast, Longgang Branch (Longwan National Forest Park, B2) is primarily covered with broadleaf mixed forests, such as *Quercus mongolica* and some pine forests. Macrofungi can show preferences for broadleaf or coniferous trees, vegetation, or substrate specificity might have contributed to the evolution of macrofungi [11,70]. Our result (Figure 6) shows that the typical composition of recorded macrofungi varied in proportion across the six investigation sites. Jelly fungi, for example, at site B2 reached 13%; however, they were only 1–3% at the other investigation sites. Furthermore, deadwood fungi prefer different deadwood characteristics (host species, decay, etc.), and thus, species composition changes can occur about these characteristics [72]. It is evidenced that macrofungi species are usually more abundant in broadleaf forests than in coniferous forests [11]. According to our calculations, the wood and litter saprotroph macrofungi reached 51.7% at site B2, while sites A1, A2, and B1 were 50.3%, 47.9%, and 46.3%, respectively. In addition, plant community composition determines understory light availability, humidity, and litter composition [73]. At the same time, many macrofungal species have host associations with particular plant species; for example, Tuo et al. revealed that the quantity of EM fungi in Wunvfeng National Forest Park, China, was positively correlated with the amount of *Q. mongolica* [6]. Based on our results, site A1 had the highest proportion of EM fungi at

45.78% and site B2 had the lowest at 28.57% among Mt. Changbai and its branch sites. The balance between mycorrhizal macrofungi and saprophytic macrofungi is a reference to forest conditions [74–77]. In a healthy forest, the number of mycorrhizal macrofungi often exceeds the number of saprophytic macrofungi [78,79]. Moreover, the plant community constitutes an abiotic factor of crucial importance for fungal composition [80,81]. However, some studies have demonstrated that the contribution of plant communities to the impact of macrofungi communities is only 1–10% [82]. Therefore, the effects of plant communities on macrofungi require further investigation.

4.3. The Influence of Topography on Macrofungi Occurrence

The ratio of mycorrhizal macrofungi to saprophytic macrofungi decreased with the transition from the eastern mountains to the central plains. Unlike light or soil properties, the topography is an indirect environmental variable [83,84]. Topography is considered an essential driver of micro-habitat diversity in forest ecosystems [85,86], as different topographies result in various micro-habitats. Different micro-habitats can favor the occurrence of a wider variety of macrofungal species [84], thus leading to different macrofungi compositions, which we observed in our results. In our findings, the proportion of macrofungal composition types varied across six survey sites (Figure 6). Moreover, the species numbers for each genus shifted with topography (Figure 14). For example, the *Lepiota* and *Geastrum* species were most common at site C2; however, they were considered rare at the other sites.

Different macrofungi compositions eventually result in variations in species similarity. Species similarity decreased with the transition from the mountainous area to the plains area in this investigation. Furthermore, the similarity between Mt. Changbai and its Laoyeling Branch (Shengli Forestry Farm, B1) was higher than between Mt. Changbai and the Mt. Longgang branch (Longwan National Forest Park, B2). Based on the comparison of the representative vegetation and soil types of the three areas, the representative forest types and soil types in the Laoyeling Branch and Mt. Changbai area were highly similar, and it is speculated that the occurrence of macrofungi is not only related to vegetation but also closely related to soil types. Soil type influenced spore density and the percentage of mycorrhizal colonization of roots, where high spore density was not necessarily connected with intensive mycorrhizal development [87].

5. Conclusions

The occurrence of macrofungi is closely related to vegetation. By comparing sites B1 and B2, we found that the macrofungal abundance increased with increasing proportions of broadleaf trees, and specific genera were present at every survey site. Moreover, the nutritional patterns of co-occurring genera (species) were analyzed, most of which were saprophytic macrofungi.

The mycorrhizal:saprophytic ratios decreased with the transition from mountains to plains. The mycorrhizal:saprophytic ratios were consistently higher in the northeast than the southwest sites in the Mt. Changbai region and its branches.

Species similarity decreased with the transition from the mountainous area to the plains area; in addition, the species similarity between the Laoyeling Branch (B1) and Mt. Changbai (A) is higher than that between the Mt. Longgang Branch (B2) and Mt. Changbai (A).

The main environmental factors affecting macrofungi occurrence from the eastern mountains to the central plains of Jilin Province are the air humidity (RH), precipitation (P), and wind speed (S) from July to September. Our canonical correspondence analysis reveals the importance of wind speed in macrofungal occurrence.

Author Contributions: Conceptualization, Y.L. and B.Z.; experimental design and methodology, Y.L., B.Z., J.-J.H. and Y.-L.T.; performance of practical work, J.-J.H. and G.-P.Z.; statistical analyses, J.-J.H., Y.-L.T., Z.-X.Q. and L.Y.; validation, J.-J.H. and B.Z.; writing—original draft preparation, J.-J.H.; writing—review and editing, B.Z.; supervision, Y.L. and B.Z.; project administration, B.Z.; funding acquisition, B.Z. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Macrofungi list of collected species in three different landforms from Jilin Province.

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Abortiporus biennis (Bull.) Singer	√						SS	Medicinal	PHT fungi	
Agaricus abruptibulbus Peck	√						SS	Edible, Poisonous	Agarics	ON683434
Agaricus arvensis Schaeff.					√		SS	Edible, Medicinal	Agarics	
Agaricus bresadolanus Bohus	√						SS	Edible, Medicinal	Agarics	
Agaricus campestris L.	√		√		√	√	SS	Edible, Medicinal	Agarics	
Agaricus comtulus Fr.	√			√			SS	Edible	Agarics	
Agaricus micromegethus Peck	√				√	√	SS	Edible, Medicinal	Agarics	
Agaricus moelleri Wasser			√			√	SS	Edible, Poisonous	Agarics	ON683435
Agaricus perrarus Fr.						√	SS	Others	Agarics	
Agaricus placomyces Peck					√		SS	Edible, Medicinal	Agarics	
Agaricus purpurellus F.H. Møller						√	SS	Others	Agarics	
Agaricus silvaticus Schaeff.			√	√			SS	Edible, Medicinal	Agarics	
Agaricus silvicolae-similis Bohus and Locsmándi	√				√		SS	Others	Agarics	
Agaricus subrufescens Peck	√				√		SS	Edible, Medicinal	Agarics	
Agaricus subrutilescens (Kauffman) Hotson and D.E. Stuntz	√		√			√	SS	Edible, Medicinal	Agarics	
Agaricus sylvaticus Schaeff.	√					√	SS	Edible, Medicinal	Agarics	
Agrocybe pediades (Fr.) Fayod					√	√	SS	Edible, Medicinal	Agarics	
Agrocybe praecox (Pers.) Fayod	√		√		√	√	SS	Edible, Medicinal	Agarics	ON683416
Aleuria aurantia (Pers.) Fuckel	√				√		SS	Edible, Medicinal, Poisonous	Larger Ascomycetes	
Aleurodiscus stereoides Yasuda						√	SS	Others	PHT fungi	
Amanita ceciliae (Berk. and Broome) Bas	√			√			EM	Others	Agarics	ON683421
Amanita fulva Fr.					√	√	EM	Others	Agarics	
Amanita hemibapha (Berk. and Broome) Sacc.			√		√		EM	Edible, Medicinal	Agarics	
Amanita imazekii T. Oda, C. Tanaka and Tsuda	√			√			EM	Edible	Agarics	
Amanita longistriata S. Imai	√		√		√		EM	Poisonous	Agarics	
Amanita nivalis Grev.	√			√			EM	Edible	Agarics	
Amanita pantherina (DC.) Krombh	√		√	√	√		EM	Poisonous	Agarics	
Amanita phalloides (Vaill. ex Fr.) Link	√					√	EM	Others	Agarics	ON683436
Amanita porphyria Alb. and Schwein.			√				EM	Others	Agarics	ON683437
Amanita spreta (Peck) Sacc.					√		EM	Others	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Amanita subjunquillea S. Imai	√		√	√		√	EM	Poisonous	Agarics	ON683438
Amanita vaginata (Bull.) Lam.	√		√	√	√	√	EM	Edible, Medicinal, Poisonous	Agarics	ON683439
Amanita virosa Secr.	√			√			EM	Medicinal, Poisonous	Agarics	
Amanitopsis fulva (Fr.) W.G. Sm.					√		EM	Others	Agarics	
Ampulloclitocybe clavipes (Pers.) Redhead, Lutzoni, Moncalvo and Vilgalys	√	√	√	√	√	√	LS	Edible, Medicinal, Poisonous	Agarics	
Apioperdon pyriforme (Schaeff.) Vizzini	√			√	√		EM	Edible, Medicinal	Gasteroid fungi	
Armillaria borealis Marxm. and Korhonen	√			√			WS	Edible, Medicinal	Agarics	
Armillaria cepistipes Velen.	√				√		WS	Others	Agarics	
Armillaria gallica Marxm. and Romagn.	√						WS	Edible, Medicinal	Agarics	ON683440
Armillaria mellea (Vahl) P. Kumm.	√	√		√	√		WS	Edible, Medicinal	Agarics	
Armillaria ostoyae (Romagn.) Herink	√	√					WS	Edible, Medicinal	Agarics	
Armillaria sinapina Bérubé and Dessur.	√						WS	Edible, Medicinal	Agarics	ON683422
Armillariella mellea (Vahl) P. Karst.		√	√		√	√	WS	Edible, Medicinal	Agarics	
Artomyces pyxidatus (Pers.) Jülich	√	√	√		√		WS	Edible	Coral fungi	
Ascocoryne cylichnium (Tul.) Korf		√	√		√		WS	Others	Larger Ascomycetes	
Astraeus hygrometricus (Pers.) Morgan	√						SS	Medicinal	Gasteroid fungi	
Atheniella adonis (Bull.) Redhead, Moncalvo, Vilgalys, Desjardin, and B.A. Perry	√			√			LS	Others	Agarics	
Auricularia cornea Ehrenb.		√	√	√	√	√	WS	Edible, Medicinal	Jelly fungi	
Auricularia heimuer F. Wu, B.K. Cui, and Y.C. Dai		√	√	√			WS	Edible, Medicinal	Jelly fungi	
Auricularia mesenterica (Dicks.) Pers.		√			√	√	WS	Others	Jelly fungi	
Auricularia nigricans (Sw.) Birkebak, Looney and Sánchez-García			√		√	√	WS	Edible, Medicinal	Jelly fungi	
Auriscalpium vulgare Gray			√		√	√	WS	Others	PHT fungi	
Baeospora myriadophylla (Peck) Singer		√					LS	Others	Agarics	
Bisporella sulfurina (Quél.) S.E. Carp.	√		√				WS	Others	Larger Ascomycetes	
Bjerkandera adusta (Willd.) P. Karst.	√				√		WS	Medicinal	PHT fungi	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Bolbitius vitellinus (Pers.) Fr.					√		SS	Others	Agarics	
Bolbitius vitellinus (Pers.) Fr.	√			√			EM	Others	Boletes	
Boletinellus merulioides (Schwein.) Murrill			√			√	EM	Others	Boletes	
Boletus edulis Bull.	√		√	√	√		EM	Edible	Boletes	
Boletus subtomentosus J.A. Palmer	√						EM	Others	Boletes	
Boletus subvelutipes Peck						√	EM	Others	Boletes	
Boletus yunnanensis W.F. Chiu					√		EM	Poisonous	Boletes	
Bovista pusilla (Batsch) Pers.	√						SS	Others	Gasteroid fungi	
Bovista pusilliformis (Kreisel) Kreisel						√	SS	Others	Gasteroid fungi	
Bulgaria inquinans (Pers.) Fr.		√					WS	Edible, Medicinal, Poisonous	Larger Ascomycetes	
Byssomerulius corium (Pers.) Parmasto						√	WS	Others	PHT fungi	
Calocera cornea (Batsch) Fr.	√	√					WS	Others	Jelly fungi	
Calocera viscosa (Pers.) Fr.			√				WS	Medicinal, Poisonous	Jelly fungi	
Calocybe gambosa (Fr.) Donk	√					√	SS	Edible, Medicinal	Agarics	
Calocybe ionides (Bull.) Donk						√	SS	Edible	Agarics	
Calvatia craniiformis (Schwein.) Fr. ex De Toni	√				√		SS	Edible, Medicinal	Gasteroid fungi	
Calvatia lilacina (Mont. and Berk.) Henn.					√		SS	Edible, Medicinal	Gasteroid fungi	
Calvatia tatrensis Hollós			√				SS	Medicinal	Gasteroid fungi	
Camarophyllus pratensis (Pers.) P. Kumm.					√		SS	Others	Agarics	
Campanella tristis (G. Stev.) Segedin	√	√					WS	Others	Agarics	
Cantharellus cibarius Fr.	√	√	√		√	√	EM	Edible, Medicinal	Cantharelloid fungi	ON683495
Cantharellus minor Peck	√				√		EM	Edible, Medicinal	Cantharelloid fungi	
Cerioporus squamosus (Huds.) Quél.	√		√		√	√	WS	Medicinal	PHT fungi	
Cerioporus varius (Pers.) Zmitr. and Kovalenko					√		WS	Edible	PHT fungi	
Ceriporia tarda (Berk.) Ginns	√			√			WS	Others	PHT fungi	
Cheilymenia coprinaria (Cooke) Boud.					√	√	WS	Others	Larger Ascomycetes	
Chlorociboria aeruginascens (Nyl.) Kanouse				√	√		WS	Others	Larger Ascomycetes	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Chroogomphus purpurascens (Lj.N. Vassiljeva) M.M. Nazarova		√		√			EM	Edible	Boletes	
Chroogomphus roseolus Y.C. Li and Zhu L. Yang					√		EM	Edible, Medicinal	Boletes	
Chroogomphus rutilus (Schaeff.) O.K. Mill.		√	√		√	√	EM	Edible, Medicinal	Boletes	ON683423
Chroogomphus tomentosus (Murrill) O.K. Mill.					√	√	EM	Others	Boletes	
Chrysomphalina aurantiaca (Peck) Redhead	√				√	√	WS	Others	Agarics	
Clavaria fragilis Holmsk.				√		√	SS	Medicinal, Poisonous	Coral fungi	
Clavaria vermicularis Sw.			√				SS	Edible	Coral fungi	
Clavariadelphus pistillaris (L.) Donk			√		√		LS	Edible, Poisonous	Coral fungi	ON683441
Clavicorona pyxidata (Pers.) Doty						√	WS	Others	Coral fungi	
Clavulina coralloides (L.) J. Schröt.	√				√		LS	Edible	Coral fungi	ON683424
Clavulinopsis corniculata (Schaeff.) Corner			√			√	LS	Edible	Coral fungi	
Clavulinopsis fusiformis (Sowerby) Corner			√	√			LS	Edible	Coral fungi	
Clavulinopsis helvola (Pers.) Corner						√	LS	Edible	Coral fungi	
Clitocybe infundibuliformis (Schaeff.) Quél.				√	√	√	LS	Edible, Medicinal	Agarics	
Clitocybe nebularis (Batsch) P. Kumm.		√					LS	Edible, Medicinal	Agarics	
Clitocybe odora (Bull.) P. Kumm.						√	LS	Edible, Medicinal	Agarics	ON683417
Clitocybe phyllophila (Pers.) P. Kumm.	√			√	√		LS	Poisonous	Agarics	
Clitopilus prunulus (Scop.) P. Kumm.	√	√		√			LS	Edible	Agarics	
Collybia nivea (Mont.) Dennis						√	SS	Others	Agarics	
Collybiopsis confluens (Pers.) R.H. Petersen		√	√		√	√	SS	Others	Agarics	ON683418
Collybiopsis peronata (Bolton) R.H. Petersen	√		√		√		SS	Others	Agarics	
Coltricia cinnamomea (Jacq.) Murrill		√	√		√	√	SS	Others	PHT fungi	
Coltricia perennis (L.) Murrill	√	√					SS	Others	PHT fungi	
Connopus acervatus (Fr.) K.W. Hughes, Mather and R.H. Petersen		√	√	√	√	√	SS	Edible	Agarics	
Conocybe lactea (J.E. Lange) Métrod			√		√	√	SS	Medicinal	Agarics	
Conocybe tenera (Schaeff.) Kühner					√		SS	Poisonous	Agarics	
Coprinellus disseminatus (Pers.) J.E. Lange	√		√	√	√	√	SS	Poisonous	Agarics	
Coprinellus micaceus (Bull.) Vilgalys, Hopple and Jacq. Johnson	√	√	√	√	√		SS	Medicinal, Poisonous	Agarics	
Coprinopsis atramentaria (Bull.) Redhead, Vilgalys and Moncalvo		√	√		√		SS	Edible, Medicinal, Poisonous	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Coprinopsis cinerea (Schaeff.) Redhead, Vilgalys and Moncalvo					√	√	SS	Medicinal	Agarics	
Coprinopsis insignis (Peck) Redhead, Vilgalys & Moncalvo			√				SS	Medicinal	Agarics	
Coprinopsis lagopus (Fr.) Redhead, Vilgalys and Moncalvo	√	√	√				SS	Medicinal	Agarics	
Coprinopsis picacea (Bull.) Redhead, Vilgalys and Moncalvo					√		SS	Poisonous	Agarics	
Coprinus comatus (O.F. Müll.) Pers.		√	√			√	DS	Edible, Medicinal, Poisonous	Agarics	
Coprinus micaceus (Bull.) Fr.						√	DS	Medicinal, Poisonous	Agarics	
Coprinus plicatilis (Curtis) Fr.		√	√				DS	Others	Agarics	
Coprinus sterquilinus (Fr.) Fr.	√		√	√			DS	Medicinal	Agarics	
Cordyceps farinosa (Holmsk.) Kepler, B. Shrestha and Spatafora						√	EI	Others	Larger Ascomycetes	
Cordyceps militaris (L.) Fr.		√	√		√	√	EI	Edible, Medicinal	Larger Ascomycetes	
Cordyceps nutans Pat.		√					EI	Others	Larger Ascomycetes	
Coriolopsis gallica (Fr.) Ryvarden			√		√	√	WS	Others	PHT fungi	
Cortinarius alboviolaceus (Pers.) Fr.		√					EM	Edible	Agarics	
Cortinarius armillatus (Fr.) Fr.		√					EM	Others	Agarics	
Cortinarius bovinus Fr.					√		EM	Edible, Medicinal	Agarics	
Cortinarius caerulescens (Schaeff.) Fr.			√		√		EM	Others	Agarics	
Cortinarius callochrous (Pers.) Gray	√		√	√			EM	Edible, Poisonous	Agarics	
Cortinarius caperatus (Pers.) Fr.			√				EM	Edible, Medicinal	Agarics	
Cortinarius cinnamomeus (L.) Gray			√	√			EM	Edible, Medicinal, Poisonous	Agarics	
Cortinarius collinitus (Sowerby) Gray					√		EM	Edible, Medicinal	Agarics	
Cortinarius colymbadinus Fr.					√		EM	Others	Agarics	
Cortinarius elatior Fr.	√				√		EM	Others	Agarics	
Cortinarius galeroides Hongo	√		√				EM	Others	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Cortinarius lilacinus Peck				√			EM	Poisonous	Agarics	
Cortinarius longipes Peck						√	EM	Others	Agarics	
Cortinarius multiformis Fr.	√						EM	Edible	Agarics	
Cortinarius orellanus Fr.	√						EM	Poisonous	Agarics	
Cortinarius purpurascens Fr.			√				EM	Edible	Agarics	ON683425
Cortinarius sanguineus (Wulfen) Gray			√			√	EM	Medicinal, Poisonous	Agarics	
Cortinarius trivialis J.E. Lange	√						EM	Edible, Poisonous	Agarics	
Cotylidia diaphana (Cooke) Lentz	√						LS	Others	PHT fungi	
Cotylidia komabensis (Henn.) D.A. Reid			√		√	√	LS	Others	PHT fungi	
Craterellus undulatus (Pers.) E. Campo and Papetti	√				√	√	EM	Edible	Agarics	
Crepidotus applanatus (Pers.) P. Kumm.		√	√				WS	Others	Agarics	
Crepidotus badiofloccosus S. Imai		√					WS	Others	Agarics	
Crepidotus betulae Murrill		√	√				WS	Others	Agarics	
Crepidotus brasiliensis Rick		√		√			WS	Medicinal	Agarics	
Crepidotus epibryus (Fr.) Quél.	√						WS	Others	Agarics	
Crepidotus fulvotomentosus (Peck) Peck			√				WS	Others	Agarics	
Crepidotus herbarum Sacc.			√				WS	Others	Agarics	
Crepidotus mollis (Schaeff.) Staude	√	√			√	√	WS	Others	Agarics	
Crepidotus nephrode (Berk. and M.A. Curtis) Sacc.			√				WS	Others	Agarics	
Crepidotus nephrodes (Berk. and M.A. Curtis) Sacc.	√						WS	Others	Agarics	
Crepidotus palmularis (Berk. and M.A. Curtis) Sacc.	√		√				WS	Others	Agarics	
Crepidotus sulphurinus Imazeki and Toki	√	√	√				WS	Others	Agarics	
Crepidotus variabilis (Pers.) P. Kumm.			√				WS	Others	Agarics	
Crinipellis stipitaria (Fr.) Pat.					√		LS	Others	Agarics	
Cuphophyllus pratensis (Pers.) Bon		√	√				SS	Edible	Agarics	ON683442
Cuphophyllus virgineus (Wulfen) Kovalenko	√		√		√		SS	Others	Agarics	
Cyanosporus caesius (Schrad.) McGinty		√	√		√	√	WS	Others	PHT fungi	
Cyathus stercoreus (Schwein.) De Toni					√		WS	Medicinal	Gasteroid fungi	
Cyathus striatus Willd.		√					WS	Medicinal	Gasteroid fungi	
Cyclocybe cylindracea (DC.) Vizzini and Angelini					√		SS	Edible, Medicinal	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Cyclocybe erebia (Fr.) Vizzini and Matheny						√	SS	Edible, Medicinal	Agarics	
Cystoderma amianthinum (Scop.) Fayod	√	√	√				SS	Edible	Agarics	
Cystoderma fallax A.H. Sm. and Singer		√					SS	Edible	Agarics	
Cystodermella granulosa (Batsch) Harmaja		√					SS	Edible	Agarics	
Dacrymyces chrysospermus Berk. and M.A. Curtis	√	√				√	WS	Others	Jelly fungi	
Dacrymyces palmatus Bres.			√				WS	Medicinal	Jelly fungi	ON683443
Dacryopinax spathularia (Schwein.) G.W. Martin	√	√		√	√	√	WS	Others	Jelly fungi	
Daedalea dickinsii Yasuda		√	√		√		WS	Medicinal	PHT fungi	ON683444
Daedaleopsis confragosa (Bolton) J. Schröt.		√			√		WS	Others	PHT fungi	
Daedaleopsis tricolor (Bull.) Bondartsev and Singer	√	√			√		WS	Medicinal	PHT fungi	ON683426
Daldinia concentrica (Bolton) Ces. and De Not.	√	√	√	√	√	√	WS	Medicinal, Poisonous	Larger Ascomycetes	
Daldinia grandis Child				√			WS	Others	Larger Ascomycetes	
Deconica coprophila (Bull.) P. Karst.					√	√	DS	Poisonous	Agarics	
Deconica merdaria (Fr.) Noordel.					√		DS	Poisonous	Agarics	
Desarmillaria tabescens (Scop.) R.A. Koch and Aime	√	√	√				SS	Edible, Medicinal, Poisonous	Agarics	
Descolea flavoannulata (Lj.N. Vassiljeva) E. Horak				√	√		SS	Edible	Agarics	
Dumontinia tuberosa (Bull.) L.M. Kohn			√		√	√	SS	Others	Larger Ascomycetes	
Entoloma abortivum (Berk. and M.A. Curtis) Donk		√					SS	Edible, Medicinal	Agarics	
Entoloma albipes Hesler	√				√		SS	Others	Agarics	
Entoloma chamaecyparidis (Hongo) Hongo						√	SS	Others	Agarics	
Entoloma clypeatum (L.) P. Kumm.	√	√	√		√	√	SS	Medicinal, Poisonous	Agarics	
Entoloma japonicum (Hongo) Hongo and Izawa						√	SS	Others	Agarics	
Entoloma lividum Quél.			√				SS	Others	Agarics	
Entoloma murinipes (Murrill) Hesler	√			√			SS	Others	Agarics	
Entoloma murrillii Hesler	√						SS	Others	Agarics	
Entoloma politum (Pers.) Noordel.	√			√			SS	Others	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Entoloma rhodopolium (Fr.) P. Kumm.	√		√	√	√	√	SS	Medicinal, Poisonous	Agarics	
Entoloma sinuatum (Bull.) P. Kumm.	√	√			√		SS	Medicinal, Poisonous	Agarics	
Entoloma speculum (Fr.) Quél.	√		√	√			SS	Others	Agarics	
Entoloma umbilicatum Dennis	√		√				SS	Others	Agarics	
Entonaema liquescens Möller	√	√		√			WS	Others	Larger Ascomycetes	
Exidia glandulosa (Bull.) Fr.	√		√	√	√		WS	Edible, Poisonous	Jelly fungi	
Flammulaster erinaceellus (Peck) Watling	√	√			√	√	WS	Others	Agarics	
Flammulina filiformis (Z.W. Ge, X.B. Liu, and Zhu L. Yang) P.M. Wang, Y.C. Dai, E. Horak, and Zhu L. Yang	√	√	√	√	√	√	WS	Edible	Agarics	
Fomes fomentarius (L.) Fr.	√	√		√			WS	Medicinal	PHT fungi	ON683445
Fomitopsis betulina (Bull.) B.K. Cui, M.L. Han, and Y.C. Dai			√				WS	Medicinal	PHT fungi	
Fomitopsis officinalis (Vill.) Bondartsev and Singer		√	√				WS	Medicinal	PHT fungi	
Fomitopsis pinicola (Sw.) P. Karst.		√					WS	Medicinal	PHT fungi	ON683446
Galerina helvoliceps (Berk. and M.A. Curtis) Singer						√	WS	Poisonous	PHT fungi	
Galerina marginata (Batsch) Kühner		√				√	SS	Poisonous	PHT fungi	
Galerina vittaeformis (Fr.) Singer					√		SS	Others	Agarics	
Galiella amurensis (Lj.N. Vassiljeva) Raitv.		√					SS	Others	Larger Ascomycetes	
Ganoderma applanatum (Pers.) Pat.	√	√	√	√	√	√	WS	Medicinal	PHT fungi	
Ganoderma tsugae Murrill	√	√			√		WS	Medicinal	PHT fungi	
Geastrum fimbriatum Fr.		√		√			LS	Medicinal	Gasteroid fungi	
Geastrum pectinatum Pers.						√	LS	Others	Gasteroid fungi	
Geastrum saccatum Fr.			√	√	√	√	LS	Medicinal	Gasteroid fungi	
Geastrum triplex Jungh.		√			√	√	LS	Medicinal	Gasteroid fungi	
Gerronema albidum (Fr.) Singer	√					√	SS	Edible	Agarics	
Gliophorus psittacinu (Schaeff.) Herink						√	SS	Edible, Poisonous	Agarics	
Gloeophyllum sepiarium (Wulfen) P. Karst.		√					WS	Medicinal	PHT fungi	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Gloeophyllum subferrugineum (Berk.) Bondartsev and Singer	√			√			WS	Others	PHT fungi	
Gloeophyllum trabeum (Pers.) Murrill					√		WS	Medicinal	PHT fungi	
Gloeostereum incarnatum S. Ito and S. Imai		√			√	√	WS	Edible, Medicinal	PHT fungi	
Gomphidius maculatus (Scop.) Fr.		√					EM	Edible	Boletes	
Gomphus clavatus (Pers.) Gray					√		EM	Edible, Medicinal	Cantharelloid fungi	
Guepinia helvelloides (DC.) Fr.	√			√			SS	Edible	Jelly fungi	
Gymnopilus aeruginosus (Peck) Singer		√	√				WS	Others	Agarics	
Gymnopilus junonius (Fr.) P.D. Orton		√					WS	Others	Agarics	
Gymnopilus liquiritiae (Pers.) P. Karst.		√			√		WS	Medicinal, Poisonous	Agarics	
Gymnopilus penetrans (Fr.) Murrill	√						WS	Poisonous	Agarics	ON683447
Gymnopus alkalivirens (Singer) Halling					√		LS	Others	Agarics	
Gymnopus androsaceus (L.) J.L. Mata and R.H. Petersen			√		√	√	LS	Medicinal	Agarics	
Gymnopus dryophilus (Bull.) Murril	√	√	√	√	√	√	LS	Edible, Poisonous	Agarics	ON683448
Gymnopus erythropus (Pers.) Antonín, Halling and Noordel.				√			LS	Edible	Agarics	ON683449
Gymnopus fusipes (Bull.) Gray					√	√	LS	Edible	Agarics	
Gymnopus ocior (Pers.) Antonín and Noordel.						√	LS	Edible	Agarics	
Gymnopus polyphyllus (Peck) Halling	√						LS	Others	Agarics	
Harrya chromipes (Frost) Halling, Nuhn, Osmundson and Manfr. Binder					√		EM	Others	Boletes	
Hebeloma hiemale Bres.			√				SS	Others	Agarics	
Hebeloma radicosum (Bull.) Ricken			√				SS	Edible, Poisonous	Agarics	
Helvella atra J. König						√	SS	Edible	Larger Ascomycetes	
Helvella crispa (Scop.) Fr.	√	√	√	√	√	√	SS	Edible, Poisonous	Larger Ascomycetes	
Helvella elastica Bull.	√		√	√	√	√	SS	Edible, Poisonous	Larger Ascomycetes	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Helvella ephippium Lév.					√	√	SS	Edible	Larger Ascomycetes	
Helvella lacunosa Afzel.			√			√	SS	Edible, Medicinal	Larger Ascomycetes	
Hemistropharia albocrenulata (Peck) Jacobsson and E. Larss.						√	WS	Edible, Poisonous	Agarics	
Hericium coralloides (Scop.) Pers.		√					WS	Edible, Medicinal	PHT fungi	
Hericium erinaceus (Bull.) Pers.	√	√	√				WS	Edible, Medicinal	PHT fungi	ON683494
Heterobasidion insulare (Murrill) Ryvarden		√	√				WS	Others	PHT fungi	
Hohenbuehelia reniformis (G. Mey.) Singer		√				√	WS	Edible	Agarics	
Hohenbuehelia serotina (Pers.) Singer				√			WS	Others	Agarics	
Hortiboletus rubellus (Krombh.) Simonini, Vizzini and Gelardi	√					√	EM	Edible, Medicinal	Boletes	
Humaria hemisphaerica (F.H. Wigg.) Fuckel	√		√		√	√	SS	Others	Larger Ascomycetes	
Hydnum repandum L.			√	√	√	√	EM	Edible, Medicinal	PHT fungi	
Hygrocybe ceracea (Sowerby) P. Kumm.	√			√			SS	Edible	Agarics	
Hygrocybe chlorophana (Fr.) Wünsche			√				SS	Edible	Agarics	
Hygrocybe coccinea (Schaeff.) P. Kumm.			√				SS	Edible	Agarics	
Hygrocybe conica (Schaeff.) P. Kumm.		√	√	√	√		SS	Medicinal, Poisonous	Agarics	
Hygrocybe flavescens (Kauffman) Singer			√				SS	Poisonous	Agarics	
Hygrocybe marchii (Bres.) Singer	√			√			SS	Others	Agarics	
Hygrocybe miniata (Fr.) P. Kumm.	√		√			√	SS	Edible	Agarics	ON683450
Hygrophorus chrysodon (Batsch) Fr.	√				√	√	SS	Edible	Agarics	
Hygrophorus eburneus (Bull.) Fr.			√	√			SS	Edible	Agarics	
Hygrophorus laurae Morgan	√					√	SS	Others	Agarics	
Hygrophorus lucorum Kalchbr.	√	√			√		SS	Edible, Medicinal	Agarics	
Hygrophorus occidentalis A.H. Sm. and Hesler	√		√				SS	Others	Agarics	
Hygrophorus olivaceo-albus (Fr.) Fr.			√				SS	Edible	Agarics	
Hygrophorus piceae Kühner	√			√			SS	Others	Agarics	
Hygrophorus pseudochrysaspis Hesler and A.H. Sm.	√		√		√		SS	Others	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Hygrophorus russula (Schaeff. ex Fr.) Kauffman	√		√				SS	Edible	Agarics	ON683451
Hymenochaete adusta (Lév.) Har. and Pat.						√	WS	Others	PHT fungi	
Hymenochaete corrugata (Fr.) Lév.	√	√				√	WS	Others	PHT fungi	
Hymenochaete xerantica (Berk.) S.H. He and Y.C. Dai						√	WS	Others	PHT fungi	
Hymenopellis radicata (Relhan) R.H. Petersen					√	√	SS	Others	Agarics	
Hymenoscyphus fructigenus (Bull.) Gray						√	WS	Others	Larger Ascomycetes	
Hypholoma capnoides (Fr.) P. Kumm.		√					WS	Medicinal, Poisonous	Agarics	
Hypholoma fasciculare (Huds.) P. Kumm.		√	√	√	√	√	WS	Medicinal, Poisonous	Agarics	
Hypholoma lateritium (Schaeff.) P. Kumm.		√	√				WS	Poisonous	Agarics	
Hypsizygus marmoreus (Peck) H.E. Bigelow		√					WS	Others	Agarics	ON683452
Hypsizygus ulmarius (Bull.) Redhead		√		√			WS	Edible, Medicinal	Agarics	
Infundibulicybe geotropa (Bull.) Harmaja	√						SS	Edible, Medicinal, Poisonous	Agarics	
Infundibulicybe gibba (Pers.) P. Kumm.	√	√		√	√		LS	Edible	Agarics	ON683453
Inocybe asterospora Quél.					√	√	EM	Poisonous	Agarics	
Inocybe calamistrata (Fr.) Gillet					√		EM	Poisonous	Agarics	
Inocybe changbaiensis T. Bau and Y.G. Fan	√			√			EM	Others	Agarics	
Inocybe cookei Bres.				√			EM	Poisonous	Agarics	
Inocybe earleana Kauffma	√			√			EM	Others	Agarics	
Inocybe euviolacea E. Ludw.						√	EM	Others	Agarics	
Inocybe fulvella Bres.	√						EM	Others	Agarics	
Inocybe geophylla P. Kumm.	√		√		√	√	EM	Poisonous	Agarics	
Inocybe napipes J.E. Lange	√				√		EM	Poisonous	Agarics	
Inocybe praetervisa Quél.					√		EM	Poisonous	Agarics	
Inocybe subalbidodisca Stangl and J. Veselský	√				√		EM	Others	Agarics	
Inocybe umbrinella Bres.	√			√	√		EM	Others	Agarics	
Inonotus hispidus (Bull.) P. Karst.	√						WS	Medicinal	PHT fungi	ON683454
Inonotus obliquus (Fr.) Pilát				√			WS	Medicinal	PHT fungi	
Inosperma calamistratum (Fr.) Matheny and Esteve-Rav.						√	LS	Others	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Irpex lacteus (Fr.) Fr.		√			√		WS	Others	PHT fungi	
Isaria japonica Yasuda						√	EI	Others	Larger Ascomycetes	
Junghuhnia nitida (Pers.) Ryvarden						√	WS	Edible	PHT fungi	
Kuehneromyces mutabilis (Schaeff.) Singer and A.H. Sm.	√	√	√		√		WS	Edible	Agarics	ON683455
Laccaria alba Zhu L. Yang and Lan Wang	√			√			EM	Edible	Agarics	ON683456
Laccaria amethystea (Bull.) Murrill			√	√		√	EM	Others	Agarics	ON683457
Laccaria amethystina Cooke	√						EM	Others	Agarics	
Laccaria laccata (Scop.) Cooke	√		√	√	√		EM	Edible, Medicinal	Agarics	ON683458
Laccaria proxima (Boud.) Pat.	√		√				EM	Others	Agarics	
Laccaria purpureobadia D.A. Reid				√			EM	Others	Agarics	
Laccaria tortilis (Bolton) Cooke	√						EM	Edible, Medicinal	Agarics	ON683459
Lacrymaria lacrymabunda (Bull.) Pat.					√		SS	Poisonous	Agarics	
Lactarius acris (Bolton) Gray				√			EM	Others	Agarics	
Lactarius aurantiacus (Pers.) Gray	√		√				EM	Edible, Medicinal	Agarics	
Lactarius camphoratus (Bull.) Fr.			√		√		EM	Edible	Agarics	
Lactarius circellatus Fr.			√				EM	Edible	Agarics	
Lactarius deliciosus (L.) Gray	√				√	√	EM	Edible, Medicinal	Agarics	
Lactarius fuliginosus (Fr.) Fr.			√				EM	Edible	Agarics	
Lactarius hatsudake Nobuj. Tanaka	√		√			√	EM	Edible, Medicinal	Agarics	
Lactarius lignyotus Fr.					√		EM	Medicinal, Poisonous	Agarics	
Lactarius mitissimus (Fr.) Fr.			√				EM	Others	Agarics	
Lactarius piperatus (L.) Pers.	√		√	√	√	√	EM	Edible, Medicinal, Poisonous	Agarics	
Lactarius subdulcis (Pers.) Gray	√						EM	Edible	Agarics	
Lactarius theiogalus (Bull.) Gray	√						EM	Others	Agarics	
Lactarius torminosus (Schaeff.) Pers.			√			√	EM	Poisonous	Agarics	
Lactarius trivialis (Fr.) Fr.					√		EM	Others	Agarics	
Lactarius vellereus (Fr.) Fr.	√		√				EM	Edible, Medicinal, Poisonous	Agarics	
Lactarius vietus (Fr.) Fr.	√		√	√			EM	Edible	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Lactarius volemus (Fr.) Fr.	√		√				EM	Edible, Medicinal	Agarics	ON683460
Lactarius zonarius (Bull.) Fr.	√				√		EM	Medicinal, Poisonous	Agarics	
Lactifluus subpiperatus (Hongo) Verbeken	√				√		EM	Others	Agarics	
Laetiporus cremeiporus Y. Ota and T. Hatt.		√					WS	Edible, Medicinal	PHT fungi	
Laetiporus montanus Černý ex Tomšovský and Jankovský		√					WS	Edible	PHT fungi	
Laetiporus sulphureus (Bull.) Murrill			√	√	√		WS	Edible, Medicinal	PHT fungi	ON683461
Leccinum chromapes (Frost) Singer			√			√	EM	Others	Boletes	
Leccinum scabrum (Bull.) Gray	√		√		√	√	EM	Edible, Poisonous	Boletes	
Lentinellus flabelliformis (Bolton) S. Ito	√	√					WS	Others	Agarics	
Lentinellus ursinus (Fr.) Kühner		√			√	√	WS	Edible	Agarics	
Lentinula edodes (Berk.) Pegler		√					WS	Edible, Medicinal	Agarics	
Lentinus arcularius (Batsch) Zmitr.	√	√	√		√	√	WS	Medicinal	PHT fungi	
Lentinus brumalis (Pers.) Zmitr.	√						WS	Edible	PHT fungi	
Lentinus elmeri Bres.			√				WS	Others	PHT fungi	
Lentinus substrictus (Bolton) Zmitr. and Kovalenko		√		√			WS	Others	PHT fungi	
Lentinus tigrinus (Bull.) Fr.		√		√			WS	Edible, Medicinal	PHT fungi	
Lenzites albida (Fr.) Fr.			√				WS	Edible	PHT fungi	
Lenzites betulinus (L.) Fr.		√			√	√	WS	Medicinal	PHT fungi	
Lenzites repanda Fr.			√				WS	Poisonous	PHT fungi	
Leotia lubrica (Scop.) Pers.			√			√	SS	Others	Larger Ascomycetes	
Lepiota brunneoincarnata Chodat and C. Martín						√	LS	Poisonous	Agarics	
Lepiota castanea Quél.	√			√	√	√	LS	Poisonous	Agarics	
Lepiota clypeolaria (Bull.) P. Kumm.	√				√	√	LS	Poisonous	Agarics	ON683462
Lepiota cristata (Bolton) P. Kumm.	√		√	√	√	√	LS	Poisonous	Agarics	
Lepiota erminea (Fr.) P. Kumm.	√					√	LS	Edible	Agarics	
Lepiota felina (Pers.) P. Karst.	√		√		√		LS	Others	Agarics	
Lepiota fusciceps Hongo						√	LS	Others	Agarics	
Lepiota magnispora Murrill				√			LS	Others	Agarics	
Lepista glaucocana (Bres.) Singer	√					√	LS	Edible	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Lepista irina (Fr.) H.E. Bigelow	√	√	√				LS	Medicinal, Poisonous	Agarics	
Lepista nuda (Bull.) Cooke	√	√	√	√	√	√	LS	Edible, Medicinal	Agarics	ON683463
Lepista personata (Fr.) Cooke	√				√		LS	Edible, Medicinal	Agarics	
Lepista sordida (Schumach.) Singer		√			√	√	LS	Edible, Medicinal	Agarics	
Leucoagaricus leucothites (Vittad.) Wasser	√					√	SS	Edible, Medicinal, Poisonous	Agarics	
Leucoagaricus rubrotinctus (Peck) Singer	√		√		√		SS	Others	Agarics	ON683464
Leucocoprinus brebissonii (Godey) Locq.	√			√			SS	Others	Agarics	
Leucocybe candicans (Pers.) Vizzini, P. Alvarado, G. Moreno, and Consiglio						√	SS	Medicinal, Poisonous	Agarics	
Leucocybe connata (Schumach.) Vizzini, P. Alvarado, G. Moreno, and Consiglio			√		√		SS	Edible, Poisonous	Agarics	
Leucocybe houghtonii (W. Phillips) Halama and Pencak.				√			SS	Others	Agarics	
Lopharia cinerascens (Schwein.) G. Cunn.						√	WS	Others	PHT fungi	
Lycoperdon fuscum Huds.						√	SS	Edible, Medicinal	Gasteroid fungi	
Lycoperdon mammaeforme Pers.			√		√	√	SS	Others	Gasteroid fungi	
Lycoperdon pedicellatum Batsch					√		SS	Edible, Medicinal	Gasteroid fungi	
Lycoperdon perlatum Pers.	√	√			√	√	SS	Edible, Medicinal	Gasteroid fungi	ON683465
Lycoperdon pusillum Hedw.					√		SS	Others	Gasteroid fungi	
Lycoperdon pyriforme Schaeff.		√					SS	Edible, Medicinal	Gasteroid fungi	
Lycoperdon umbrinum Pers.	√		√		√		SS	Edible, Medicinal	Gasteroid fungi	
Lyophyllum decastes (Fr.) Singer		√			√		EM	Edible, Medicinal	Agarics	
Lysurus mokusin (L.) Fr.					√	√	SS	Medicinal	Gasteroid fungi	
Macrocystidia cucumis (Pers.) Joss.			√			√	SS	Others	Agarics	
Macrolepiota procera (Scop.) Singer	√	√	√	√	√	√	SS	Edible, Medicinal, Poisonous	Agarics	
Mallocybe terrigena (Fr.) Matheny, Vizzini, and Esteve-Rav.				√			SS	Edible	Agarics	
Marasmiellus candidus (Fr.) Singer					√		WS	Others	Agarics	
Marasmiellus eburneus (Theiss.) Singer	√		√				WS	Others	Agarics	
Marasmiellus ramealis (Bull.) Singer	√			√	√	√	WS	Medicinal	Agarics	
Marasmius aurantiacus I. Hino					√		LS	Edible, Medicinal	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Marasmius beniensis Singer			√				LS	Others	Agarics	
Marasmius chordalis Fr.	√				√		LS	Others	Agarics	
Marasmius cohaerens (Pers.) Cooke and Quél.	√		√		√	√	LS	Others	Agarics	
Marasmius epiphyllus (Pers.) Fr.			√				LS	Others	Agarics	
Marasmius floriceps Berk. and M.A. Curtis	√						LS	Others	Agarics	
Marasmius maximus Hongo	√		√		√		LS	Edible	Agarics	ON683427
Marasmius occultatiformis Antonín, Ryoo, and H.D. Shin	√				√		LS	Others	Agarics	ON683419
Marasmius oreades (Bolton) Fr.	√				√	√	LS	Edible, Medicinal	Agarics	
Marasmius pallidocephalus Gilliam	√			√			LS	Others	Agarics	
Marasmius polylepidis Dennis	√			√			LS	Others	Agarics	
Marasmius pseudoniveus Singer			√				LS	Others	Agarics	
Marasmius pulcherripes Peck						√	LS	Others	Agarics	
Marasmius riparius Singer	√		√		√		LS	Others	Agarics	
Marasmius rotuloides Dennis	√			√			LS	Others	Agarics	
Marasmius sessiliaffinis Singer			√				LS	Others	Agarics	
Marasmius siccus (Schwein.) Fr.	√		√			√	LS	Others	Agarics	
Megacollybia platyphylla (Pers.) Kotl. and Pouzar			√				WS	Others	Agarics	
Melanoleuca brevipes (Bull.) Pat.						√	SS	Edible	Agarics	
Melanoleuca grammopodia (Bull.) Murrill	√		√				SS	Edible	Agarics	
Melanoleuca melaleuca (Pers.) Murrill	√				√	√	SS	Edible	Agarics	ON683466
Melanoleuca strictipes (P. Karst.) Jul. Schäff.	√						SS	Edible	Agarics	
Melanoleuca stridula (Fr.) Singer					√	√	SS	Others	Agarics	
Melanoleuca verrucipes (Fr.) Singer	√			√		√	SS	Edible	Agarics	
Melastiza chateri (W.G. Sm.) Boud.						√	SS	Others	Larger Ascomycetes	
Microporus affinis (Blume and T. Nees) Kuntze	√						WS	Others	PHT fungi	
Microstoma floccosum (Sacc.) Raitv.		√					WS	Others	Larger Ascomycetes	
Morchella conica Pers.						√	SS	Edible	Larger Ascomycetes	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Morchella crassipes (Vent.) Pers.					√	√	SS	Edible, Medicinal	Larger Ascomycetes	
Morchella esculenta (L.) Pers.	√		√		√	√	SS	Edible, Medicinal	Larger Ascomycetes	
Morchella vulgaris (Pers.) Gray			√				SS	Edible, Medicinal	Larger Ascomycetes	
Mucidula brunneomarginata (Lj.N. Vassiljeva) R.H. Petersen		√	√	√			WS	Edible	Agarics	
Mucidula mucida (Schrad.) Pat.	√	√	√	√			WS	Others	Agarics	ON683467
Mutinus caninus (Huds.) Fr.			√			√	SS	Poisonous	Gasteroid fungi	
Mycena alphitophora (Berk.) Sacc.						√	LS	Others	Agarics	
Mycena collybiiformis (Murrill) Murrill	√						LS	Others	Agarics	
Mycena debilis (Fr.) Quél.	√		√				LS	Others	Agarics	
Mycena epipterygia (Scop.) Gray	√						LS	Others	Agarics	
Mycena filopes (Bull.) P. Kumm.					√		LS	Others	Agarics	
Mycena flavescens Velen.	√			√			LS	Poisonous	Agarics	
Mycena fuliginella A.H. Sm.	√		√				LS	Others	Agarics	
Mycena galericulata (Scop.) Gray	√		√		√		LS	Edible, Medicinal	Agarics	ON683420
Mycena haematopus (Pers.) P. Kumm.	√	√	√	√	√		LS	Medicinal, Poisonous	Agarics	ON683468
Mycena inclinata (Fr.) Quél.	√						LS	Others	Agarics	
Mycena nucleata X. He and X.D. Fang	√			√			LS	Others	Agarics	
Mycena osmundicola J.E. Lange			√				LS	Others	Agarics	
Mycena pseudoandrosacea (Bull.) Z.S. Bi	√		√				LS	Others	Agarics	
Mycena pura (Pers.) P. Kumm.	√	√	√	√	√	√	LS	Medicinal, Poisonous	Agarics	ON683469
Mycena rosea Gramberg	√			√			LS	Others	Agarics	
Mycena sanguinolenta (Alb. and Schwein.) P. Kumm.	√						LS	Others	Agarics	
Mycena subcana A.H. Sm.	√						LS	Others	Agarics	
Mycena subgracilis Métrod	√			√			LS	Others	Agarics	
Mycoleptodonoides pergamenea (Yasuda) Aoshima and H. Furuk.		√		√			WS	Others	PHT fungi	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Myxarium nucleatum Wallr.	√		√	√			WS	Others	Larger Ascomycetes	
Naematelia aurantialba (Bandoni and M. Zang) Millanes and Wedin	√		√				WS	Edible, Medicinal	Jelly fungi	
Neofavolus alveolaris (DC.) Sotome and T. Hatt.			√				WS	Others	PHT fungi	ON683470
Neolentinus adhaerens (Alb. and Schwein.) Redhead and Ginns		√					WS	Edible, Medicinal	PHT fungi	
Neolentinus cyathiformis (Schaeff.) Della Magg. and Trassin.		√					WS	Others	PHT fungi	
Neolentinus lepideus (Fr.) Redhead and Ginns	√	√	√	√	√	√	WS	Edible, Medicinal, Poisonous	PHT fungi	ON683471
Nidula niveotomentosa (Henn.) Lloyd						√	WS	Medicinal	Agarics	
Omphalina lilaceorosea Svrček and Kubička		√					LS	Others	Agarics	
Omphalotus guepiniformis (Berk.) Neda	√	√	√				WS	Poisonous	Agarics	
Onnia tomentosa (Fr.) P. Karst.					√		WS	Others	PHT fungi	
Ophiocordyceps nutans (Pat.) G.H. Sung, J.M. Sung, Hywel-Jones, and Spatafora				√			EI	Medicinal	Larger Ascomycetes	
Ophiocordyceps sphecocephala (Klotzsch ex Berk.) G.H. Sung, J.M. Sung, Hywel-Jones, and Spatafora		√				√	EI	Medicinal	Larger Ascomycetes	
Ossicaulis lignatilis (Pers.) Redhead and Ginns		√				√	WS	Edible	Agarics	
Osteina undosa (Peck) Zmitr.						√	WS	Others	PHT fungi	
Otidea cochleata (L.) Fuckel	√		√	√	√	√	SS	Poisonous	Larger Ascomycetes	
Otidea leporina (Batsch) Fuckel				√			SS	Others	Larger Ascomycetes	
Oudemansiella radicata (Relhan) Singer		√					SS	Others	Agarics	
Panaeolus campanulatus (L.) Quél.			√				DS	Others	Agarics	
Panaeolus fimicola (Pers.) Gillet	√		√				DS	Poisonous	Agarics	
Panaeolus papilionaceus (Bull.) Quél.	√				√	√	DS	Poisonous	Agarics	
Panellus stipticus (Bull.) P. Karst.	√	√			√		WS	Medicinal, Poisonous	Agarics	ON683472

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Panus conchatus (Bull.) Fr.		√					WS	Edible, Medicinal	Agarics	ON673473
Panus rudis Fr.					√	√	WS	Others	Agarics	
Paralepista splendens (Pers.) Vizzini	√		√		√		SS	Others	Agarics	
Paralepistopsis acromelalga (Ichimura) Vizzini						√	SS	Poisonous	Agarics	
Parasola plicatilis (Curtis) Redhead, Vilgalys, and Hopple	√			√			SS	Medicinal	Agarics	
Parasola leiocephala (P.D. Orton) Redhead, Vilgalys and Hopple	√	√					SS	Others	Agarics	
Paxillus involutus (Batsch) Fr.		√	√		√	√	EM	Medicinal, Poisonous	Boletes	
Perenniporia inflexibilis (Berk.) Ryvarden	√			√			WS	Others	PHT fungi	
Perenniporia medulla-panis (Jacq.) Donk			√			√	WS	Others	PHT fungi	
Perenniporia subacida (Peck) Donk			√			√	WS	Medicinal	PHT fungi	
Peziza ampliata Pers.			√				SS	Others	Larger Ascomycetes	
Peziza badia Pers.		√		√	√	√	SS	Poisonous	Larger Ascomycetes	
Peziza praetervisa Bres.	√		√			√	SS	Others	Larger Ascomycetes	
Peziza sylvestris (Boud.) Sacc. and Traverso					√		SS	Others	Larger Ascomycetes	
Peziza vesiculosa Bolton		√	√		√	√	SS	Edible, Poisonous	Larger Ascomycetes	
Phaeoclavulina abietina (Pers.) Giachini			√				LS	Others	Coral fungi	
Phaeoclavulina flaccida (Fr.) Giachini			√				LS	Poisonous	Coral fungi	
Phaeolepiota aurea (Matt.) Maire				√	√		SS	Edible, Medicinal, Poisonous	Agarics	
Phaeolus schweinitzii (Fr.) Pat.					√		WS	Medicinal	PHT fungi	
Phaeotremella foliacea (Pers.) Wedin, J.C. Zamora and Millanes			√		√		EM	Edible, Medicinal	Jelly fungi	
Phallus flavocostatus Kreisel	√		√				SS	Others	Gasteroid fungi	ON683474

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Phallus hadriani Vent.						√	SS	Others	Gasteroid fungi	
Phallus impudicus L.	√				√	√	SS	Edible, Medicinal	Gasteroid fungi	
Phallus indusiatus Vent.					√		SS	Others	Gasteroid fungi	
Phallus rubicundus (Bosc) Fr.	√						SS	Medicinal, Poisonous	Gasteroid fungi	
Phallus rugulosus (E. Fisch.) Lloyd					√	√	SS	Others	Gasteroid fungi	
Phellinus gilvus (Schwein.) Pat.					√	√	WS	Others	PHT fungi	
Phellinus igniarius (L.) Quél.		√					WS	Medicinal	PHT fungi	
Phellodon fuligineoalbus (J.C. Schmidt) R.E. Baird			√				WS	Others	PHT fungi	
Phellodon tomentosus (L.) Banker	√						WS	Edible	PHT fungi	
Phillipsia domingensis (Berk.) Berk. ex Denison		√	√				WS	Others	Larger Ascomycetes	
Phlebia tremellosa (Schrad.) Nakasone and Burds.					√		WS	Medicinal	PHT fungi	
Phloeomana minutula (Sacc.) Redhead	√						WS	Others	Agarics	
Phloeomana speirea (Fr.) Redhead			√		√	√	WS	Others	Agarics	
Pholiota adiposa (Batsch) P. Kumm.	√	√		√		√	WS	Edible, Medicinal	Agarics	
Pholiota aurivella (Batsch) P. Kumm.		√	√	√	√	√	WS	Edible, Medicinal	Agarics	
Pholiota flammans (Batsch) P. Kumm.	√	√	√		√		WS	Edible, Medicinal, Poisonous	Agarics	
Pholiota hiemalis A.H. Sm. and Hesler		√		√			WS	Others	Agarics	
Pholiota lenta (Pers.) Singer			√				WS	Edible, Medicinal	Agarics	
Pholiota lubrica (Pers.) Singer	√						WS	Edible, Medicinal, Poisonous	Agarics	ON683475
Pholiota mutabilis (Schaeff.) P. Kumm.					√		WS	Others	Agarics	
Pholiota spumosa (Fr.) Singer	√			√	√		WS	Edible, Medicinal	Agarics	ON683476
Pholiota squarrosa (Vahl) P. Kumm.	√	√	√		√		WS	Edible, Medicinal, Poisonous	Agarics	
Pholiota squarrosoides (Peck) Sacc.	√	√	√		√		WS	Edible, Poisonous	Agarics	ON683477
Pholiota subflavida (Murrill) A.H. Sm. and Hesler	√				√		WS	Others	Agarics	
Pholiota tuberculosa (Schaeff.) P. Kumm.			√				WS	Others	Agarics	
Pholiota veris A.H. Sm. and Hesler						√	WS	Others	Agarics	
Pholiota vinaceobrunnea A.H. Sm. and Hesler		√					WS	Others	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Pholiota terrestris Overh.	√	√	√		√		WS	Edible, Medicinal, Poisonous	Agarics	
Phyllotopsis nidulans (Pers.) Singer			√			√	WS	Edible	Agarics	
Physalacria lateriparies X. He and F.Z. Xue					√		WS	Others	Agarics	
Picipes badius (Pers.) Zmitr. and Kovalenko			√			√	WS	Others	PHT fungi	ON683478
Picipes melanopus (Pers.) Zmitr. and Kovalenko			√				WS	Others	PHT fungi	
Piptoporus betulinus (Bull.) P. Karst.		√		√			WS	Medicinal	PHT fungi	
Plectania melastoma (Sowerby) Fuckel	√			√			WS	Others	Larger Ascomycetes	
Pleuroflammula flammea (Murrill) Singer		√					SS	Others	Agarics	
Pleuroflammula multifolia (Peck) E. Horak	√						SS	Others	Agarics	
Pleurotus citrinopileatus Singer	√	√	√				WS	Edible, Medicinal	Agarics	ON683479
Pleurotus cornucopiae (Paulet) Quél.	√	√	√		√		WS	Edible, Medicinal	Agarics	
Pleurotus corticatus (Fr.) P. Kumm.			√				WS	Others	Agarics	
Pleurotus dryinus (Pers.) P. Kumm.	√			√			WS	Edible, Medicinal	Agarics	
Pleurotus limpidus (Fr.) P. Karst.	√				√		WS	Edible	Agarics	
Pleurotus ostreatus (Jacq.) P. Kumm.	√	√	√	√	√	√	WS	Edible, Medicinal	Agarics	ON683480
Pleurotus pulmonarius (Fr.) Quél.	√	√	√		√	√	WS	Edible, Medicinal	Agarics	ON683481
Pleurotus spodoleucus (Fr.) Quél.	√			√			WS	Edible, Medicinal	Agarics	
Pluteus atricapillus (Batsch) Fayod			√				WS	Others	Agarics	
Pluteus atromarginatus (Konrad) Kühner						√	WS	Edible	Agarics	
Pluteus aurantiorugosus (Trog) Sacc.		√	√		√		WS	Edible	Agarics	ON683482
Pluteus cervinus (Schaeff.) P. Kumm.	√	√		√	√	√	WS	Edible	Agarics	
Pluteus depauperatus Romagn.			√				WS	Others	Agarics	
Pluteus leoninus (Schaeff.) P. Kumm.		√	√		√		WS	Edible	Agarics	
Pluteus nanus (Pers.) P. Kumm.			√		√		WS	Others	Agarics	
Pluteus petasatus (Fr.) Gillet					√	√	WS	Edible	Agarics	
Pluteus plautus (Weinm.) Gillet	√	√					WS	Others	Agarics	
Pluteus salicinus (Pers.) P. Kumm.		√	√				WS	Edible	Agarics	
Pluteus umbrosus (Pers.) P. Kumm.	√						WS	Edible	Agarics	
Podosordaria pedunculata (Dicks.) Dennis		√		√			WS	Others	Larger Ascomycetes	
Polyporus alveolaris (DC.) Bondartsev and Singer					√	√	WS	Others	PHT fungi	
Polyporus badius (Pers.) Schwein.					√		WS	Others	PHT fungi	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Polyporus brumalis (Pers.) Fr.		√					WS	Others	PHT fungi	
Polyporus conifericola H.J. Xue and L.W. Zhou		√					WS	Others	PHT fungi	ON683483
Polyporus squamosus (Huds.) Fr.		√					WS	Medicinal	PHT fungi	
Polyporus tuberaster (Jacq. ex Pers.) Fr.		√		√			WS	Others	PHT fungi	
Polyporus varius (Pers.) Fr.		√					WS	Medicinal	PHT fungi	
Polystictus unicolor Rick	√				√		WS	Others	PHT fungi	
Polystictus versicolor (L.) Fr.					√		WS	Others	PHT fungi	
Psathyrella candolleana (Fr.) Maire	√	√			√	√	WS	Medicinal, Poisonous	Agarics	ON683484
Psathyrella hydrophila (Bull.) Maire					√		WS	Others	Agarics	
Psathyrella multissima (S. Imai) Hongo		√	√		√	√	WS	Others	Agarics	
Psathyrella subnuda (P. Karst.) A.H. Sm.		√	√				WS	Others	Agarics	
Pseudoclitocybe cyathiformis (Bull.) Singer	√				√	√	SS	Edible, Medicinal	Agarics	ON683485
Pseudofavolus tenuis (Fr.) G. Cunn.	√			√			WS	Medicinal, Poisonous	PHT fungi	
Pseudohydnum gelatinosum (Scop.) P. Karst.				√			WS	Edible, Medicinal	Jelly fungi	
Pseudosperma avellaneum (Kobayasi) Matheny and Esteve-Rav.	√						SS	Others	Agarics	
Pseudosperma rimosum (Bull.) Matheny and Esteve-Rav.	√		√	√	√	√	SS	Others	Agarics	
Pseudosperma umbrinellum (Bres.) Matheny and Esteve-Rav.						√	SS	Others	Agarics	
Pterula multifida (Chevall.) Fr.		√	√		√	√	SS	Others	Coral fungi	ON683486
Pycnoporus cinnabarinus (Jacq.) P. Karst.	√	√				√	WS	Medicinal	PHT fungi	
Pycnoporus sanguineus (L.) Murrill					√		WS	Medicinal	PHT fungi	
Radulodon copelandii (Pat.) N. Maek.			√			√	WS	Others	PHT fungi	
Radulomyces copelandii (Pat.) Hjortstam and Spooner		√	√				WS	Others	PHT fungi	
Ramaria apiculata (Fr.) Donk	√	√	√		√	√	EM	Edible, Medicinal	Coral fungi	
Ramaria botrytis (Pers.) Bourdot					√		EM	Edible, Medicinal	Coral fungi	
Ramaria bourdotiana Maire			√				EM	Edible	Coral fungi	
Ramaria flava (Schaeff.) Quél.	√		√		√	√	EM	Edible, Medicinal, Poisonous	Coral fungi	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Ramaria formosa (Pers.) Quél.			√				EM	Edible, Medicinal, Poisonous	Coral fungi	
Ramaria lutea Schild						√	EM	Edible	Coral fungi	
Ramaria madagascariensis (Henn.) Corner			√				EM	Others	Coral fungi	
Ramaria stricta (Pers.) Quél.	√		√		√	√	EM	Edible	Coral fungi	
Ramaria subbotrytis (Coker) Corner			√				EM	Edible	Coral fungi	
Ramariopsis kunzei (Fr.) Corner						√	EM	Edible	Coral fungi	
Resupinatus applicatus (Batsch) Gray		√				√	WS	Others	Agarics	
Rhizocybe vermicularis (Fr.) Vizzini, P. Alvarado, G. Moreno, and Consiglio			√				SS	Others	Agarics	
Rhizomarasmius undatus (Berk.) R.H. Petersen						√	SS	Others	Agarics	
Rhodocollybia butyracea (Bull.) Lennox		√					SS	Edible	Agarics	
Rhodocollybia prolixa (Fr.) Antonín and Noordel.						√	SS	Others	Agarics	
Rickenella fibula (Bull.) Raithelh.	√		√				EM	Others	Cantharelloid fungi	
Ripartites tricholoma (Alb. and Schwein.) P. Karst.	√						LS	Others	Agarics	ON683428
Russula adusta (Pers.) Fr.	√						EM	Edible, Medicinal	Agarics	
Russula aeruginea Lindblad ex Fr.	√		√		√	√	EM	Edible	Agarics	
Russula albida A. Blytt	√		√				EM	Edible	Agarics	
Russula alutacea (Fr.) Fr.					√		EM	Edible, Medicinal, Poisonous	Agarics	
Russula amoena Quél.	√		√	√		√	EM	Others	Agarics	
Russula aurata Fr.			√		√		EM	Others	Agarics	
Russula aurea Pers.	√						EM	Others	Agarics	
Russula chloroides (Krombh.) Bres.	√		√				EM	Edible	Agarics	
Russula crustosa Peck	√		√				EM	Edible, Medicinal	Agarics	ON683429
Russula cyanoxantha (Schaeff.) Fr.	√		√			√	EM	Edible, Medicinal	Agarics	ON683430
Russula delica Fr.	√				√	√	EM	Edible, Medicinal	Agarics	
Russula densifolia Secr. ex Gillet			√			√	EM	Edible, Medicinal	Agarics	ON683487
Russula emetica (Schaeff.) Pers.	√		√		√		EM	Edible, Medicinal, Poisonous	Agarics	
Russula exalbicans (Pers.) Melzer and Zvára				√			EM	Edible	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Russula faginea Romagn.			√				EM	Edible	Agarics	
Russula flavida Frost ex Peck			√		√	√	EM	Poisonous	Agarics	
Russula foetens Pers.	√		√	√	√	√	EM	Medicinal, Poisonous	Agarics	ON683488
Russula fragilis Fr.	√		√				EM	Medicinal, Poisonous	Agarics	ON683489
Russula furcata Pers.			√				EM	Edible	Agarics	
Russula grata Britzelm.			√		√	√	EM	Others	Agarics	
Russula integra (L.) Fr.	√		√				EM	Edible, Medicinal	Agarics	
Russula lilacea Quél.	√			√			EM	Edible, Medicinal	Agarics	
Russula mariae Peck						√	EM	Edible	Agarics	
Russula mustelina Fr.	√				√		EM	Edible	Agarics	
Russula nauseosa (Pers.) Fr.	√		√				EM	Edible	Agarics	
Russula paludosa Britzelm.			√	√			EM	Edible	Agarics	
Russula pectinata Fr.					√		EM	Poisonous	Agarics	
Russula pseudodelica J.E. Lange	√		√				EM	Edible, Medicinal	Agarics	
Russula puellaris Fr.	√		√				EM	Edible	Agarics	
Russula pungens Beardslee						√	EM	Others	Agarics	
Russula risigallina (Batsch) Sacc.	√			√			EM	Edible	Agarics	
Russula rosea Pers.	√						EM	Edible, Medicinal	Agarics	
Russula rubra (Lam.) Fr.	√		√				EM	Edible	Agarics	
Russula sanguinaria (Schumach.) Rauschert	√		√	√			EM	Edible	Agarics	
Russula sanguinea Fr.	√				√	√	EM	Others	Agarics	
Russula sororia (Fr.) Romell				√	√	√	EM	Medicinal	Agarics	ON683431
Russula squalida Peck				√			EM	Others	Agarics	
Russula subdepallens Peck	√		√				EM	Edible	Agarics	
Russula vinosa Lindblad				√			EM	Others	Agarics	ON683432
Sarcodontia spumea (Sowerby) Spirin	√	√	√	√	√		EM	Others	PHT fungi	
Sarcomyxa edulis (Y.C. Dai, Niemelä, and G.F. Qin) T. Saito, Tonouchi, and T. Harada	√	√			√		WS	Medicinal	Agarics	
Sarcoscypha coccinea (Gray) Boud.		√	√	√	√		WS	Poisonous	Larger Ascomycetes	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Schizophyllum commune Fr.	√	√	√	√	√	√	WS	Edible, Medicinal	Agarics	
Scleroderma areolatum Ehrenb.		√	√			√	SS	Edible, Medicinal, Poisonous	Gasteroid fungi	
Scleroderma bovista Fr.		√	√		√		SS	Edible, Medicinal	Gasteroid fungi	
Scleroderma polyrhizum (J.F. Gmel.) Pers.					√		SS	Edible, Medicinal	Gasteroid fungi	
Scutellinia pseudovitreola W.Y. Zhuang and Zhu L. Yang		√					WS	Others	Larger Ascomycetes	
Scutellinia scutellata (L.) Lambotte	√	√	√		√	√	WS	Others	Larger Ascomycetes	
Sparassis latifolia Y.C. Dai and Zheng Wang		√					WS	Edible, Medicinal	PHT fungi	ON683490
Spathularia flavida Pers.				√	√	√	SS	Others	Larger Ascomycetes	
Sphaerobolus stellatus Tode	√					√	WS	Others	Gasteroid fungi	
Spongiporus zebra (Y.L. Wei and W.M. Qin) B.K. Cui, L.L. Shen, and Y.C. Dai	√					√	WS	Others	PHT fungi	
Steccherinum ochraceum (Pers. ex J.F. Gmel.) Gray			√				WS	Others	PHT fungi	
Steccherinum rawakense (Pers.) Banker	√			√			WS	Others	PHT fungi	
Stereum hirsutum (Willd.) Pers.	√	√			√	√	WS	Medicinal	PHT fungi	
Stereum rugosum Pers.	√				√		WS	Others	PHT fungi	
Stereum subtomentosum Pouzar		√					WS	Others	PHT fungi	
Stereum ostrea (Blume and T. Nees) Fr.	√	√	√		√		WS	Others	PHT fungi	
Strobilurus stephanocystis (Kühner and Romagn. ex Hora) Singer						√	WS	Others	Agarics	
Stropharia aeruginosa (Curtis) Quél.		√	√		√		SS	Edible, Poisonous	Agarics	
Stropharia rugosoannulata Farl. ex Murrill	√	√			√		SS	Edible, Medicinal	Agarics	
Suillellus luridus (Schaeff.) Murrill					√		EM	Edible, Medicinal	Boletes	
Suillus bovinus (L.) Roussel					√	√	EM	Edible, Medicinal, Poisonous	Boletes	
Suillus flavus (Quél.) Singer	√				√		EM	Others	Boletes	
Suillus granulatus (L.) Roussel	√		√	√	√	√	EM	Edible, Medicinal, Poisonous	Boletes	ON683433
Suillus grevillei (Klotzsch) Singer	√			√	√	√	EM	Edible, Medicinal	Boletes	
Suillus lactifluus (With.) A.H. Sm. and Thiers						√	EM	Edible	Boletes	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Suillus laricinus (Berk.) Kuntze					√	√	EM	Others	Boletes	
Suillus luteus (L.) Roussel	√				√		EM	Edible, Medicinal, Poisonous	Boletes	
Suillus spraguei (Berk. and M.A. Curtis) Kuntze	√						EM	Others	Boletes	
Suillus subaureus (Peck) Snell			√				EM	Edible, Medicinal	Boletes	
Suillus viscidus (L.) Roussel	√				√		EM	Edible, Medicinal	Boletes	
Tapinella atrotomentosa (Batsch) Šutara			√		√	√	EM	Medicinal, Poisonous	Boletes	
Tapinella panuoides (Fr.) E.-J. Gilbert		√		√			EM	Poisonous	Boletes	
Terana caerulea (Lam.) Kuntze			√			√	WS	Others	PHT fungi	
Tetrapyrgos nigripes (Fr.) E. Horak	√	√				√	WS	Others	Agarics	
Thelephora anthocephala (Bull.) Fr.			√	√			SS	Others	PHT fungi	
Thelephora palmata (Scop.) Fr.					√	√	SS	Others	PHT fungi	
Tolypocladium capitatum (Holmsk.) C.A. Quandt, Kepler, and Spatafora						√	EI	Others	Larger Ascomycetes	
Trametes coccinea (Fr.) Hai J. Li and S.H. He		√	√				WS	Others	PHT fungi	
Trametes conchifer (Schwein.) Pilát		√		√			WS	Others	PHT fungi	
Trametes gibbosa (Pers.) Fr.	√				√		WS	Medicinal	PHT fungi	ON683491
Trametes hirsuta (Wulfen) Lloyd			√		√	√	WS	Medicinal	PHT fungi	
Trametes membranacea (Sw.) Kreisel						√	WS	Others	PHT fungi	
Trametes pubescens (Schumach.) Pilát	√			√			WS	Edible, Medicinal, Poisonous	PHT fungi	
Trametes suaveolens (L.) Fr.	√				√	√	WS	Medicinal	PHT fungi	
Trametes trogi Berk.					√		WS	Poisonous	PHT fungi	
Trametes versicolor (L.) Lloyd	√	√	√	√		√	WS	Medicinal	PHT fungi	ON683492
Tremella aurantia Schwein.					√		WS	Edible	Jelly fungi	
Tremella foliacea Pers.		√					WS	Others	Jelly fungi	ON683493
Tremella fuciformis Berk.		√	√				WS	Edible, Medicinal	Boletes	
Tremella mesenterica (Schaeff.) Pers.	√	√				√	WS	Edible, Medicinal	Jelly fungi	
Trichaptum abietinum (Pers. ex J.F. Gmel.) Ryvarden	√			√			WS	Medicinal	PHT fungi	
Trichaptum biforme (Fr.) Ryvarden			√				WS	Medicinal	PHT fungi	
Trichaptum pargamenum (Fr.) G. Cunn.		√				√	WS	Others	PHT fungi	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Tricholoma acerbum (Bull.) Quél.	√						EM	Edible, Medicinal, Poisonous	Agarics	
Tricholoma album (Schaeff.) P. Kumm.	√		√				EM	Edible, Medicinal, Poisonous	Agarics	
Tricholoma aurantium (Schaeff.) Ricken	√				√		EM	Others	Agarics	
Tricholoma equestre (L.) P. Kumm.				√			EM	Edible, Poisonous	Agarics	
Tricholoma matsutake (S. Ito and S. Imai) Singer	√	√					EM	Edible, Medicinal	Agarics	
Tricholoma scalpturatum (Fr.) Quél.				√			EM	Edible, Poisonous	Agarics	
Tricholoma terreum (Schaeff.) P. Kumm.			√		√	√	EM	Others	Agarics	
Tricholoma tigrinum (Schaeff.) Gillet	√			√			EM	Poisonous	Agarics	
Tricholoma vaccinum (Schaeff.) P. Kumm.	√			√			EM	Edible, Medicinal	Agarics	
Tricholomopsis decora (Fr.) Singer	√						WS	Edible	Agarics	
Tricholomopsis rutilans (Schaeff.) Singer	√	√	√	√	√	√	WS	Poisonous	Agarics	
Tulostoma bonianum Pat.			√		√	√	SS	Others	Gasteroid fungi	
Turbinellus floccosus (Schwein.) Earle ex Giachini and Castellano			√	√			EM	Poisonous	Cantharelloid fungi	
Verpa bohemica (Krombh.) J. Schröt.						√	SS	Edible, Medicinal, Poisonous	Larger Ascomycetes	
Verpa digitaliformis Pers.						√	SS	Edible	Larger Ascomycetes	
Vitreoporus dichrous (Fr.) Zmitr.					√		WS	Others	PHT fungi	
Volvariella bombycina (Schaeff.) Singer			√		√		WS	Edible, Medicinal	Agarics	
Volvariella pusilla (Pers.) Singer						√	SS	Edible, Medicinal	Agarics	
Volvopluteus gloiocephalus (DC.) Vizzini, Contu and Justo			√		√		SS	Poisonous	Agarics	
Xanthochrous gilvicolor (Lloyd) Teng	√					√	WS	Others	PHT fungi	
Xerocomellus chrysenteron (Bull.) Šutara					√		EM	Others	Boletes	
Xerocomus chrysenteron (Bull.) Quél.	√				√	√	EM	Others	Boletes	
Xeromphalina campanella (Batsch) Kühner and Maire	√	√	√	√	√		WS	Medicinal	Agarics	
Xerula pudens (Pers.) Singer	√						WS	Others	Agarics	

Table A1. *Cont.*

Scientific Name	Distribution						Nutritional Mode	Economic Value	Categories	GenBank Accession Number
	A1	A2	B1	B2	C1	C2				
Xylaria carpophila (Pers.) Fr.			√			√	WS	Medicinal	Larger Ascomycetes	
Xylaria hypoxylon (L.) Grev.	√	√	√		√	√	WS	Others	Larger Ascomycetes	
Xylaria polymorpha (Pers.) Grev.		√	√	√			WS	Others	Larger Ascomycetes	

Note: EM = ectomycorrhizal; SS = soil saprotroph; WS = wood saprotroph; LS = litter saprotroph; DS = dung saprotroph; EI = endophyte insect pathogen.

Table A2. Species scientific names and their corresponding abbreviations.

Abbreviation	Genus	Abbreviation	Genus	Abbreviation	Genus	Abbreviation	Genus
Abo	*Abortiporus*	Dac	*Dacrymyces*	Lec	*Leccinum*	Pip	*Piptoporus*
Aga	*Agaricus*	Dacr	*Dacryopinax*	Len	*Lentinellus*	Ple	*Pleurotus*
Agr	*Agrocybe*	Dae	*Daedalea*	Lent	*Lentinus*	Plu	*Pluteus*
Ale	*Aleuria*	Daed	*Daedaleopsis*	Lenz	*Lenzites*	Pol	*Polyporus*
Ama	*Amanita*	Dal	*Daldinia*	Leo	*Leotia*	Poly	*Polystictus*
Amp	*Ampulloclitocybe*	Dec	*Deconica*	Lep	*Lepiota*	Pos	*Postia*
Api	*Apioperdon*	Des	*Descolea*	Lepi	*Lepista*	Psa	*Psathyrella*
Arm	*Armillaria*	Dum	*Dumontinia*	Leu	*Leucoagaricus*	Pse	*Pseudoclitocybe*
Art	*Artomyces*	Ent	*Entoloma*	Leuc	*Leucocybe*	Pseu	*Pseudosperma*
Asc	*Ascocoryne*	Exi	*Exidia*	Lyc	*Lycoperdon*	Pte	*Pterula*
Aur	*Auricularia*	Flam	*Flammulaster*	Lyo	*Lyophyllum*	Pyc	*Pycnoporus*
Auri	*Auriscalpium*	Flamm	*Flammulina*	Lys	*Lysurus*	Rad	*Radulodon*
Bis	*Bisporella*	Fom	*Fomes*	Mac	*Macrocystidia*	Ram	*Ramaria*
Bje	*Bjerkandera*	Fomi	*Fomitopsis*	Macr	*Macrolepiota*	Res	*Resupinatus*
Bol1	*Boletinellus*	Gal	*Galerina*	Mar	*Marasmiellus*	Rho	*Rhodocollybia*
Bol	*Boletus*	Gan	*Ganoderma*	Mara	*Marasmius*	Ric	*Rickenella*
Cal1	*Calocera*	Gea	*Geastrum*	Mel	*Melanoleuca*	Rus	*Russula*
Calo	*Calocybe*	Ger	*Gerronema*	Mor	*Morchella*	Sar	*Sarcodontia*
Cal	*Calvatia*	Glo	*Gloeophyllum*	Muc	*Mucidula*	Sar	*Sarcomyxa*
Can	*Cantharellus*	Gloe	*Gloeostereum*	Mut	*Mutinus*	Sarc	*Sarcoscypha*
Cer	*Cerioporus*	Gue	*Guepinia*	Myc	*Mycena*	Sch	*Schizophyllum*
Che	*Cheilymenia*	Gym	*Gymnopilus*	Neo	*Neofavolus*	Scl	*Scleroderma*
Chl	*Chlorociboria*	Gymn	*Gymnopus*	Neol	*Neolentinus*	Scu	*Scutellinia*
Chr	*Chroogomphus*	Har	*Harrya*	Omp	*Omphalotus*	Spa	*Spathularia*
Cla	*Clavaria*	Hel	*Helvella*	Oph	*Ophiocordyceps*	Ste	*Steccherinum*
Clav	*Clavariadelphus*	Hem	*Hemistropharia*	Oss	*Ossicaulis*	Ste	*Stereum*
Clavu	*Clavulina*	Her	*Hericium*	Oti	*Otidea*	Str	*Stropharia*
Clavul	*Clavulinopsis*	Het	*Heterobasidion*	Pan	*Panaeolus*	Sui	*Suillus*
Cli	*Clitocybe*	Hoh	*Hohenbuehelia*	Pane	*Panellus*	Tap	*Tapinella*
Col	*Coltricia*	Hum	*Humaria*	Panu	*Panus*	Ter	*Terana*
Con	*Connopus*	Hyd	*Hydnum*	Par	*Paralepista*	The	*Thelephora*
Cono	*Conocybe*	Hyg	*Hygrocybe*	Para	*Parasola*	Tra	*Trametes*
Cop	*Coprinellus*	Hygr	*Hygrophorus*	Pax	*Paxillus*	Tre	*Tremella*
Copr	*Coprinopsis*	Hym	*Hymenopellis*	Per	*Perenniporia*	Tri	*Trichaptum*
Copri	*Coprinus*	Hyp	*Hypholoma*	Pez	*Peziza*	Tric	*Tricholoma*
Cor	*Cordyceps*	Hyp	*Hypsizygus*	Pha	*Phaeolepiota*	Trich	*Tricholomopsis*
Cori	*Coriolopsis*	Inf	*Infundibulicybe*	Phae	*Phaeotremella*	Tul	*Tulostoma*
Cort	*Cortinarius*	Ino	*Inocybe*	Pha	*Phallus*	Tur	*Turbinellus*
Cot	*Cotylidia*	Ino	*Inonotus*	Phe	*Phellinus*	Vol	*Volvariella*
Cre	*Crepidotus*	Irp	*Irpex*	Phel	*Phellodon*	Volv	*Volvopluteus*
Cup	*Cuphophyllus*	Kue	*Kuehneromyces*	Phl	*Phloeomana*	Xer1	*Xerocomus*
Cya	*Cyathus*	Lac	*Laccaria*	Pho	*Pholiota*	Xer	*Xeromphalina*
Cyc	*Cyclocybe*	Lact	*Lactarius*	Phy	*Phyllotopsis*	Xyl	*Xylaria*
Cys	*Cystoderma*	Lae	*Laetiporus*	Pic	*Picipes*		

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